CERTIFICATION TEST REPORT

Report Number. : 4789841420-E2V1

Applicant : SAMSUNG ELECTRONICS CO., LTD.
129 SAMSUNG-RO, YEONGTONG-GU, SUWON-SI,
GYEONGGI-DO, 16677, KOREA

Model : SM-T736B

FCC ID : A3LSMT736B

EUT Description : GSM/WCDMA/LTE/5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac

Test Standard(s) : FCC CFR47 PART 22 SUBPART H
FCC CFR47 PART 24 SUBPART E
FCC CFR47 PART 27 SUBPART F,H,L,M
FCC CFR47 PART 90 SUBPART S

Date Of Issue:
2021-04-14

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IAS ACCREDITED
Testing Laboratory
TL-637

Revision History

Rev.	Issue Date	Revisions	Revised By
V1	2021-04-14	Initial issue	Yeonhee Lim

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1. ATTESTATION OF TEST RESULTS

COMPANY NAME:	SAMSUNG ELECTRONICS CO., LTD.
EUT DESCRIPTION:	GSM/WCDMA/LTE/5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac
MODEL NUMBER:	SM-T736B
SERIAL NUMBER:	R32R2008TKD, R32R2008VFL (CONDUCTED); R32R2008V6A, R32R2008R7F (RADIATED)
DATE TESTED:	2021-02-25 – 2021-04-14;

APPLICABLE STANDARDS	
STANDARD	**TEST RESULTS**
FCC PART 22H, 24E, 27 F,H,L,M 90S	Pass

UL Korea, Ltd. tested the above equipment in accordance with the requirements set forth in the above standards. All indications of Pass/Fail in this report are opinions expressed by UL Korea, Ltd. based on interpretations and/or observations of test results. Measurement Uncertainties were not taken into account and are published for informational purposes only. The test results show that the equipment tested is capable of demonstrating compliance with the requirements as documented in this report.

Note: The results documented in this report apply only to the tested sample, under the conditions and modes of operation as described herein. This document may not be altered or revised in any way unless done so by UL Korea, Ltd. and all revisions are duly noted in the revisions section. Any alteration of this document not carried out by UL Korea, Ltd. will constitute fraud and shall nullify the document. This report must not be used by the client to claim product certification, approval, or endorsement by IAS, any agency of the Federal Government, or any agency of any government.

Approved & Released For
UL Korea, Ltd. By:

Junwhan Lee
Suwon Lab Engineer
UL Korea, Ltd.

Tested By:

Yeonhee Lim
Suwon Lab Technician
UL Korea, Ltd.

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2. TEST METHODOLOGY

The tests documented in this report were performed in accordance with following methods.

1. FCC CFR 47 Part 2.
2. FCC CFR 47 Part 22.
3. FCC CFR 47 Part 24.
4. FCC CFR 47 Part 27.
5. FCC CFR 47 Part 90.
6. ANSI TIA-603-E, 2016
7. ANSI C63.26, 2015
8. KDB 971168 D01 Power Meas License Digital Systems v03r01
9. KDB 412172 D01 Determining ERP and EIRP v01r01

3. FACILITIES AND ACCREDITATION

The test sites and measurement facilities used to collect data are located at 218 Maeyeong-ro, Yeongtong-gu, Suwon-si, Gyeonggi-do,16675, Korea. Line conducted emissions are measured only at the 218 address. The following table identifies which facilities were utilized for radiated emission measurements documented in this report. Specific facilities are also identified in the test results sections.

218 Maeyeong-ro
☒ Chamber 1
☒ Chamber 2
☐ Chamber 3

UL Korea, Ltd. is accredited by IAS, Laboratory Code TL-637. The full scope of accreditation can be viewed at https://www.iasonline.org/wp-content/uploads/2017/05/TL-637-cert-New.pdf.

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4. CALIBRATION AND UNCERTAINTY

4.1. MEASURING INSTRUMENT CALIBRATION

The measuring equipment utilized to perform the tests documented in this report has been calibrated in accordance with the manufacturer's recommendations, and is traceable to recognized national standards.

4.2. SAMPLE CALCULATION

Where relevant, the following sample calculation is provided:

EIRP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna) + Substitution Antenna Factor (dBi)

ERP = PSA reading with EUT worst orientation (dBm) + Path loss (dB) – cable loss(between the SG and substitution antenna)

(Path loss = Signal generator output – PSA reading with substitution antenna)

4.3. MEASUREMENT UNCERTAINTY

Where relevant, the following measurement uncertainty levels have been estimated for tests performed on the apparatus:

PARAMETER	UNCERTAINTY
Conducted Disturbance, 0.15 to 30 MHz	3.01 dB
Radiated Disturbance, 30 MHz to 1 GHz	4.26 dB
Radiated Disturbance, 1 GHz to 18 GHz	5.90 dB
Radiated Disturbance, Above 18 GHz	5.49 dB

Uncertainty figures are valid to a confidence level of 95%.

4.4. DECISION RULE

Decision rule for statement(s) of conformity is based on Procedure 1, Clause 4.4.2 in IEC Guide 115:2007.

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5. EQUIPMENT UNDER TEST

5.1. DESCRIPTION OF EUT

The EUT is a GSM/WCDMA/LTE/5G NR Tablet + BT/BLE, DTS/UNII a/b/g/n/ac.
This test report addresses the WWAN operational mode.

5.2. MAXIMUM OUTPUT POWER

The transmitter has a maximum average radiated ERP / EIRP output powers as follows:

Note : Conducted output power results were excerpted from RF exposure test report (4789841420-S1 FCC Report SAR).

GSM

FCC Part 22/24						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
GSM850	824.2~848.8	GPRS	**33.08**	**2030.46**	**32.32**	**1706.08**
		EGPRS	27.88	613.27	29.21	833.68
GSM1900	1850.2~1909.8	GPRS	**30.49**	**1119.48**	31.70	1479.11
		EGPRS	26.53	449.99	28.81	760.33

WCDMA

FCC Part 22/24/27						
Band	Frequency Range [MHz]	Modulation	Conducted		Radiated	
			Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 5	826.4~846.6	Rel. 99	**24.49**	**280.93**	**22.57**	**180.72**
		HSDPA	23.49	223.32	21.48	140.60
		HSUPA	23.47	222.50		
Band 4	1712.4~1752.6	Rel. 99	**22.87**	**193.64**	**23.63**	**230.67**
		HSDPA	21.73	148.89	22.67	184.93
		HSUPA	21.66	146.69		
Band 2	1852.4~1907.6	Rel. 99	**22.75**	**188.36**	**23.51**	**224.39**
		HSDPA	21.89	154.59	22.63	183.23
		HSUPA	21.85	153.17		

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LTE Band 12

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 12	699 ~ 716	10	QPSK	23.87	243.57	20.05	101.16
			16QAM	23.08	203.05	19.13	81.85
			64QAM	22.14	163.51		
		5	QPSK	**23.91**	**246.01**	**20.20**	**104.71**
			16QAM	23.10	204.36	19.47	88.51
			64QAM	22.25	167.83		
		3	QPSK	23.85	242.46	20.11	102.57
			16QAM	23.12	205.33	18.91	77.80
			64QAM	22.02	159.07		
		1.4	QPSK	23.79	239.50	19.98	99.54
			16QAM	23.06	202.21	19.12	81.66
			64QAM	22.17	164.73		

LTE Band 13

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 13	777 ~ 787	10	QPSK	24.65	291.89	21.96	157.04
			16QAM	23.92	246.61	21.23	132.74
			64QAM	22.46	176.12		
		5	QPSK	**24.73**	**297.10**	**22.08**	**161.44**
			16QAM	23.88	244.43	21.08	128.23
			64QAM	22.98	198.51		

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LTE Band 25

FCC Part 24							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 25	1850 ~ 1915	20	QPSK	22.71	186.80	23.58	228.03
			16QAM	22.35	171.80	23.33	215.28
			64QAM	21.43	139.10		
		15	QPSK	22.76	188.76	23.74	236.59
			16QAM	22.14	163.72	22.71	186.64
			64QAM	21.11	129.22		
		10	QPSK	22.76	188.66	**23.98**	**250.03**
			16QAM	21.78	150.68	22.83	191.87
			64QAM	21.15	130.45		
		5	QPSK	**22.86**	**193.03**	23.72	235.50
			16QAM	22.06	160.55	22.95	197.24
			64QAM	20.86	121.88		
		3	QPSK	22.76	188.99	23.88	244.34
			16QAM	21.87	153.71	22.93	196.34
			64QAM	21.26	133.76		
		1.4	QPSK	22.82	191.44	23.75	237.14
			16QAM	22.25	167.83	22.53	179.06
			64QAM	21.29	134.51		

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LTE Band 26 (Part 90)

FCC Part 90							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	814 ~ 824	15	QPSK	24.95	312.51	22.63	183.23
			16QAM	24.14	259.23	21.72	148.59
			64QAM	23.22	210.08		
		10	QPSK	25.05	319.70	22.44	175.39
			16QAM	24.16	260.55	21.16	130.62
			64QAM	23.40	218.78		
		5	QPSK	25.03	318.63	23.36	216.77
			16QAM	24.15	259.79	22.57	180.72
			64QAM	23.23	210.52		
		3	QPSK	24.97	314.10	23.42	219.79
			16QAM	23.98	250.15	22.85	192.75
			64QAM	23.12	205.31		
		1.4	QPSK	**25.10**	**323.50**	**23.46**	**221.82**
			16QAM	24.31	269.93	22.22	166.72
			64QAM	23.42	219.75		

LTE Band 26 (Straddle)

Straddle							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824	15	QPSK	24.20	263.03	23.04	201.37
			16QAM	23.71	234.96	22.55	179.89
			64QAM	23.02	200.45		
		10	QPSK	24.40	275.42	23.44	220.80
			16QAM	24.11	257.63	22.94	196.79
			64QAM	23.00	199.53		
		5	QPSK	**24.56**	**285.76**	23.29	213.30
			16QAM	24.09	256.45	22.66	184.50
			64QAM	22.95	197.24		
		3	QPSK	24.54	284.45	**23.59**	**228.56**
			16QAM	24.19	262.42	22.49	177.42
			64QAM	22.96	197.70		
		1.4	QPSK	24.37	273.53	23.48	222.84
			16QAM	23.93	247.17	22.69	185.78
			64QAM	23.00	199.53		

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LTE Band 26 (Part 22)

FCC Part 22							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 26	824 ~ 849	15	QPSK	24.58	287.09	**23.89**	**244.91**
			16QAM	23.90	245.60	23.40	218.78
			64QAM	23.04	201.36		
		10	QPSK	24.65	291.93	23.53	225.42
			16QAM	24.14	259.50	22.59	181.55
			64QAM	23.22	209.72		
		5	QPSK	24.75	298.30	23.66	232.27
			16QAM	24.05	254.06	22.79	190.11
			64QAM	22.97	198.05		
		3	QPSK	24.71	295.82	23.79	239.33
			16QAM	23.90	245.29	23.17	207.49
			64QAM	22.95	197.15		
		1.4	QPSK	**24.79**	**301.09**	23.68	233.35
			16QAM	24.03	253.01	22.77	189.23
			64QAM	23.00	199.48		

LTE Band 41

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 41	2496 ~ 2690	20	QPSK	23.90	245.28	24.99	315.50
			16QAM	22.97	197.96	25.29	338.06
			64QAM	21.95	156.80		
		15	QPSK	23.88	244.43	25.48	353.18
			16QAM	23.00	199.73	24.43	277.33
			64QAM	21.71	148.09		
		10	QPSK	**23.94**	**247.90**	25.47	352.37
			16QAM	22.86	193.29	25.50	354.81
			64QAM	21.71	148.09		
		5	QPSK	23.91	245.91	**25.69**	**370.68**
			16QAM	23.01	200.05	25.51	355.63
			64QAM	22.31	170.19		

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LTE Band 66

FCC Part 27							
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Conducted		Radiated	
				Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
Band 66	1710 ~ 1780	20	QPSK	23.09	203.82	23.97	249.46
			16QAM	22.50	177.96	23.00	199.53
			64QAM	21.48	140.72		
		15	QPSK	23.11	204.83	24.07	255.27
			16QAM	22.52	178.67	23.05	201.84
			64QAM	21.50	141.31		
		10	QPSK	23.25	211.13	24.02	252.35
			16QAM	22.26	168.44	23.33	215.28
			64QAM	21.64	145.87		
		5	QPSK	**23.34**	**215.65**	**24.71**	**295.80**
			16QAM	22.50	177.68	22.87	193.64
			64QAM	21.34	136.25		
		3	QPSK	23.17	207.45	24.29	268.53
			16QAM	22.29	169.50	23.45	221.31
			64QAM	21.68	147.15		
		1.4	QPSK	23.21	209.36	24.34	271.64
			16QAM	22.55	179.77	23.41	219.28
			64QAM	21.60	144.54		

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LTE Band 2

LTE Band 2(Frequency range: 1850-1910 MHz) is covered by LTE Band 25 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 5

LTE Band 5 (Frequency range: 824-849 MHz) is covered by LTE Band 26 (Frequency range: 814-849 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 17

LTE Band 17 (Frequency range: 704-716 MHz) is covered by LTE Band 12 (Frequency range: 699-716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

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NR Band n5

FCC Part 22								
Band	Frequency Range [MHz]	BandWidth [MHz]	Modulation	Mode	Conducted		Radiated	
					Avg [dBm]	Avg [mW]	Avg [dBm]	Avg [mW]
n5	824-849	20	DFT-s OFDM	π/2 BPSK	24.70	295.12		
				QPSK	**24.72**	**296.48**	20.42	110.15
				16QAM	23.71	234.96	19.23	83.75
				64QAM	22.10	162.18		
				256QAM	19.75	94.41		
			CP-OFDM	QPSK	23.20	208.93		
		15	DFT-s OFDM	π/2 BPSK	24.60	288.40		
				QPSK	24.70	295.12	**21.09**	**128.53**
				16QAM	23.87	243.78	19.85	96.61
				64QAM	22.35	171.79		
				256QAM	19.40	87.10		
			CP-OFDM	QPSK	23.03	200.91		
		10	DFT-s OFDM	π/2 BPSK	24.46	279.25		
				QPSK	24.41	276.06	20.21	104.95
				16QAM	23.85	242.66	19.21	83.37
				64QAM	22.32	170.61		
				256QAM	19.68	92.90		
			CP-OFDM	QPSK	22.85	192.75		
		5	DFT-s OFDM	π/2 BPSK	24.56	285.76		
				QPSK	24.44	277.97	19.76	94.62
				16QAM	23.66	232.27	18.61	72.61
				64QAM	21.80	151.36		
				256QAM	19.43	87.70		
			CP-OFDM	QPSK	22.76	188.80		

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5.3. DESCRIPTION OF AVAILABLE ANTENNAS

The radio utilizes a internal antenna for the [List the bands supported] with a maximum peak gain as follow:

Frequency (MHz)	Peak Gain (dBi)
LTE Band 26 (Part 90) 814 ~ 824 MHz	-3.12
GSM850 / WCDMA Band 5 / LTE Band 5 / LTE Band 26 (Part 22) / NR Band n5 824 ~ 849 MHz	-3.48
WCDMA Band 4 / LTE Band 4 / LTE Band 66 1710 ~ 1780 MHz	-1.87
GSM 1900 / WCDMA Band 2 / LTE Band 2 / LTE Band 25 1850 ~ 1915 MHz	-1.29
LTE Band 12 / LTE Band 17 699 ~ 716 MHz	-3.71
LTE Band 13 777 ~ 787 MHz	-2.53
LTE Band 41 2496 ~ 2690 MHz	-1.58

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5.4. WORST-CASE ORIENTATION

Following modes should be considered as worst-case scenario for all other measurements.

- GSM GPRS/EGPRS
- UMTS REL 99/HSDPA

For all LTE/5G NR Bands, the worst-case scenario for all measurements is based on the average conducted output power measurement investigation results. Output power measurements were measured on QPSK, 16QAM, and 64QAM modulations. It was found that QPSK and 16QAM results were worst case. All testing was performed using QPSK and 16QAM modulations to represent the worst case. However, the out of band emissions and spurious radiation were only performed on bandwidth and RB offset(with RB size 1) with the highest conducted power in QPSK.

Highest power setting for each bands				
LTE Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
12	701.5	5	1	0
	707.5		1	0
	713.5		1	0
13	779.5	5	1	24
	782.0		1	24
	784.5		1	24
25	1852.5	5	1	24
	1882.5		1	24
	1912.5		1	24
26(Part 90)	814.7	1.4	1	3
	823.3		1	3
26(Straddle)	824.0	5	1	24
26(Part 22)	824.7	1.4	1	3
	831.5		1	3
	848.3		1	3
41	2498.5	5	1	0
	2593.0		1	24
	2687.5		1	24
66	1712.5	5	1	24
	1745.0		1	12
	1777.5		1	0
NR Band	**Frequency (MHz)**	**Bandwidth (MHz)**	**RB size**	**RB offset**
5	834.0	20	1	1
	836.5		1	1
	839.0		1	1

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i. Worst Axis Condition

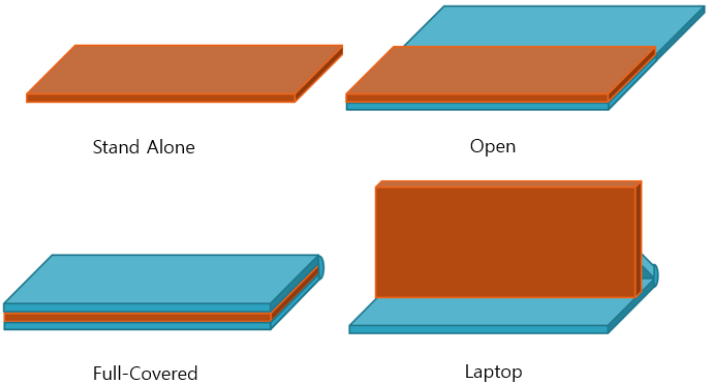
The fundamental and radiated spurious emission were investigated in three orthogonal orientations X, Y and Z, it was determined that below orientation was worst-case orientation for each band.

Band	ERP/EIRP				RSE			
	X	Y	Z	Laptop	X	Y	Z	Laptop
GSM850	-	Stand Alone	-	-	-	-	-	O
GSM1900	-	-	Stand Alone	-	Full Covered	-	-	-
WCDMA B5	-	Stand Alone	-	-	Stand Alone	-	-	-
WCDMA B4	Stand Alone	-	-	-	Stand Alone	-	-	-
WCDMA B2	Stand Alone	-	-	-	Stand Alone	-	-	-
LTE B12	-	Stand Alone	-	-	-	Stand Alone	-	-
LTE B13	-	Stand Alone	-	-	Full Covered	-	-	-
LTE B25	-	-	Stand Alone	-	Stand Alone	-	-	-
LTE B26	-	Stand Alone	-	-	-	Stand Alone	-	-
LTE B41	Stand Alone	-	-	-	Stand Alone	-	-	-
LTE B66	Full Covered	-	-	-	Full Covered	-	-	-
NR B5	-	Stand Alone	-	-	-	Stand Alone	-	-

Note : For ERP/EIRP testing, the EUT didn't attached with travel adapter. But radiated spurious testing, the EUT attached with travel adapter for the worst case condition. The EUT is continuously communicated with the call box during the tests.

ii. Foldable Condition

The Fundamental of the EUT was investigated four foldable conditions(Stand Alone, , Open, Full-Coverd, Laptop).



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5.5. DESCRIPTION OF TEST SETUP

SUPPORT EQUIPMENT

Support Equipment List				
Description	**Manufacturer**	**Model**	**Serial Number**	**FCC ID**
Charger	SAMSUNG	EP-TA200	R37R1XS0P35DK3	N/A
Data Cable	SAMSUNG	EP-DT725BBE	N/A	N/A

I/O CABLE

I/O Cable List						
Cable No	**Port**	**# of identical ports**	**Connector Type**	**Cable Type**	**Cable Length (m)**	**Remarks**
1	DC Power	1	C Type	Shielded	1.0 m	N/A

TEST SETUP

The EUT is continuously communicated with the call box during the tests.

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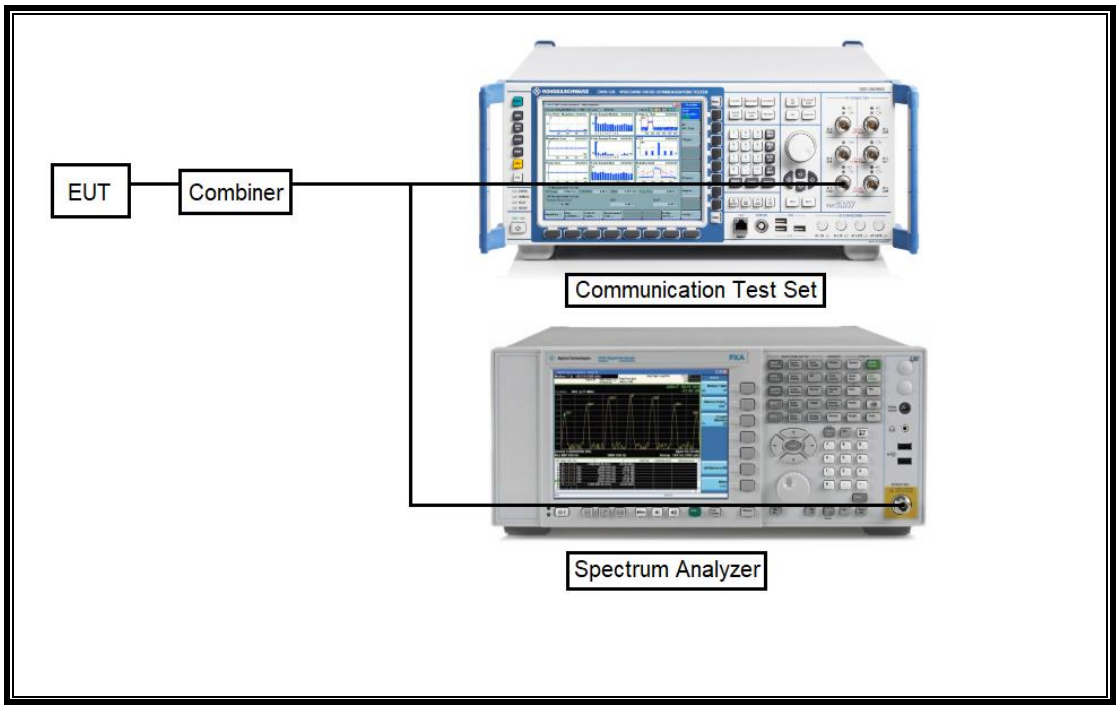
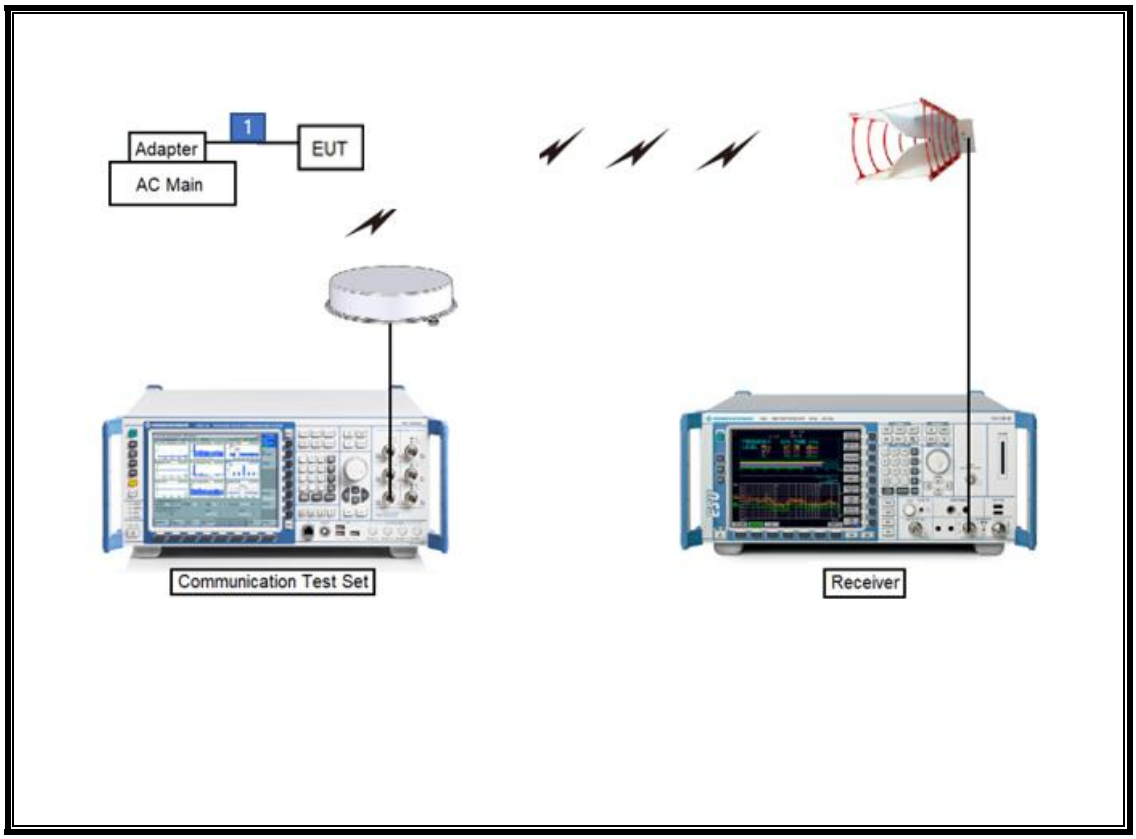
SETUP DIAGRAM FOR TESTS (CONDUCTED TEST SETUP)



SETUP DIAGRAM FOR TESTS (RADIATED TEST SETUP)



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6. TEST AND MEASUREMENT EQUIPMENT

The following test and measurement equipment was utilized for the tests documented in this report:

Test Equipment List				
Description	**Manufacturer**	**Model**	**S/N**	**Cal Due**
Antenna, Tuned Dipole 400~1000 MHz	ETS	3121D DB4	00164753	2023-02-08
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	110367-0003	N/A
Directional Antenna	Cobham	FPA3-0.8-6.0R/1329	80108-0004	N/A
Antenna, Horn, 40 GHz	ETS	3116C	00166155	2022-08-04
Antenna, Horn, 40 GHz	ETS	3116C	00168645	2021-10-02
Preamplifier	ETS	3116C-PA	00168841	2021-08-06
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	750	2022-08-19
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	845	2022-08-13
Antenna, Bilog, 30MHz-1GHz	SCHWARZBECK	VULB9163	749	2022-08-13
Antenna, Horn, 18 GHz	ETS	3115	00167211	2022-07-27
Antenna, Horn, 18 GHz	ETS	3115	00161451	2022-08-15
Antenna, Horn, 18 GHz	ETS	3117	00168724	2022-07-27
Antenna, Horn, 18 GHz	ETS	3117	00168717	2022-08-15
Communications Test Set	R&S	CMW500	150314	2021-08-04
DC Power Supply	Agilent / HP	E3640A	MY54226395	2021-08-05
Preamplifier, 1000 MHz	Sonoma	310N	341282	2021-08-03
Preamplifier, 1000 MHz	Sonoma	310N	370599	2021-08-06
Preamplifier, 1000 MHz	Sonoma	310N	351741	2021-08-03
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1876511	2021-08-03
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	2029169	2021-08-04
Preamplifier, 18 GHz	Miteq	AFS42-00101800-25-S-42	1896138	2021-08-03
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54170614	2021-08-05
Spectrum Analyzer, 44 GHz	Agilent / HP	N9030A	MY54490312	2021-08-05
EMI Test Receive, 40 GHz	R&S	ESU40	100439	2021-08-03
EMI Test Receive, 40 GHz	R&S	ESU40	100457	2021-08-03
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G005	2021-08-05
High Pass Filter 1.2GHz	Micro-Tronics	HPM50108-02	G006	2021-08-05
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	010	2021-08-05
High Pass Filter 2.8GHz	Micro-Tronics	HPM50111-02	011	2021-08-05
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G001	2021-08-05
High Pass Filter 4GHz	Micro-Tronics	HPM50118-02	G002	2021-08-05
Attenuator	PASTERNACK	PE7087-10	A009	2021-08-05
Attenuator	PASTERNACK	PE7087-10	A001	2021-08-03
Attenuator	PASTERNACK	PE7087-10	A008	2021-08-03
Attenuator	PASTERNACK	PE7004-10	2	2021-08-04
Attenuator	PASTERNACK	PE7395-10	A011	2021-08-05
Antenna, Loop, 9kHz-30MHz	R&S	HFH2-Z2	100418	2021-10-02
Temperature Chamber	ESPEC	SH-642	93001109	2021-08-04
Power Splitter	MINI-CIRCUITS	WA1534	UL001	2022-01-27
Power Splitter	MINI-CIRCUITS	WA1534	UL002	2022-01-27

UL Software			
Description	**Manufacturer**	**Model**	**Version**
Antenna port test software	UL	CLT	Ver 2.5
Radiated software	UL	UL EMC	Ver 9.5
Antenna port test software (5G NR FR1)	UL	UL iM	Ver 1.04

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7. SUMMARY TABLE

FCC Part Section	Test Description	Test Limit	Test Condition	Test Result
2.1049	Occupied Band width (99%)	N/A	Conducted	Pass
22.917(a) 24.238(a) 27.53(c),(g),(h) 90.691	Band Edge / Conducted Spurious Emission	-13dBm		Pass
27.53(m)	Conducted Spurious Emission	-25 dBm		Pass
27.53(a),(m) 90.691	Emission mask	Section 9.2.2		Pass
2.1046	Conducted output power	N/A		Pass
22.355 24.235 90.213	Frequency Stability	2.5PPM		Pass
22.913(a)(5)	Effective Radiated Power	38.5 dBm	Radiated	Pass
90.635(b)		50 dBm		Pass
27.50(b)(10) 27.50(c)(10)		34.77 dBm		Pass
24.232(c) 27.50(h)(2)	Equivalent Isotropic Radiated Power	33dBm		Pass
27.50(d)(4)		30dBm		Pass
22.917(a) 24.238(a) 27.53(c),(g),(h) 90.691	Radiated Spurious Emission	-13dBm		Pass
27.53 (m)		-25dBm		Pass

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8. PEAK TO AVERAGE RATIO

Test Procedure

Per KDB 971168 D01 Power Meas License Digital Systems v03r01;

The transmitter output was connected to a CMW500 Test Set and configured to operate at maximum power. The PAR were measured on the Spectrum Analyzer.

Test Spec

In addition, when the transmitter power is measured in terms of average value, the peak-to-average ratio of the power shall not exceed 13 dB.

Note

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

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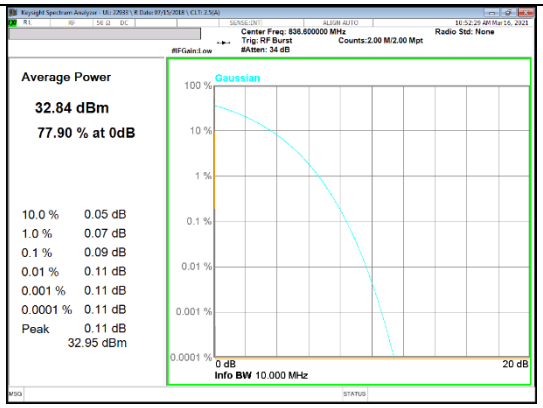
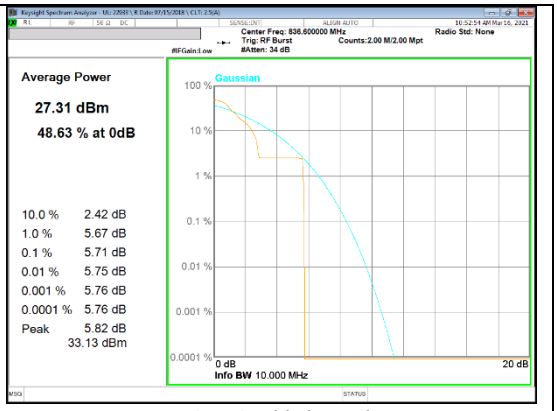
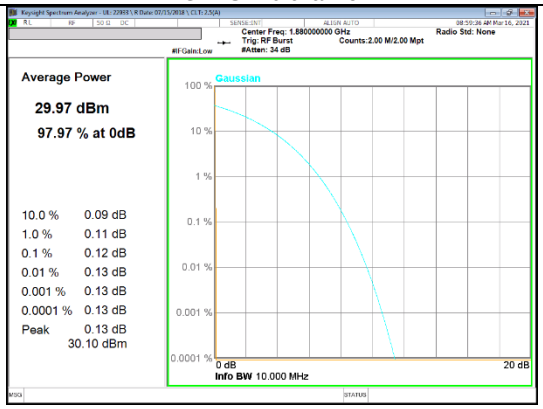
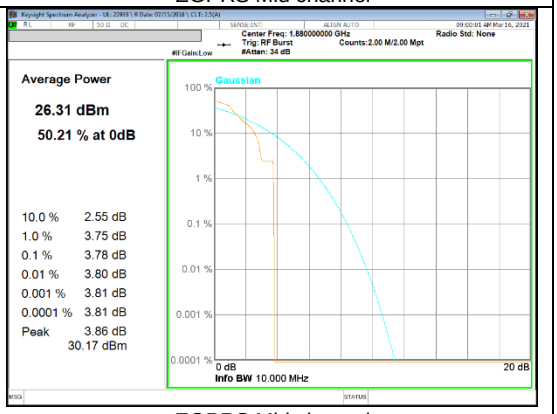
8.1. CONDUCTED PEAK TO AVERAGE RESULT

GSM

850	 GPRS Mid channel	 EGPRS Mid channel
1900	 GPRS Mid channel	 EGPRS Mid channel

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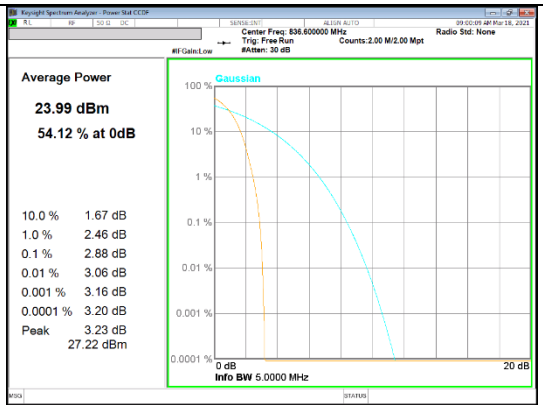
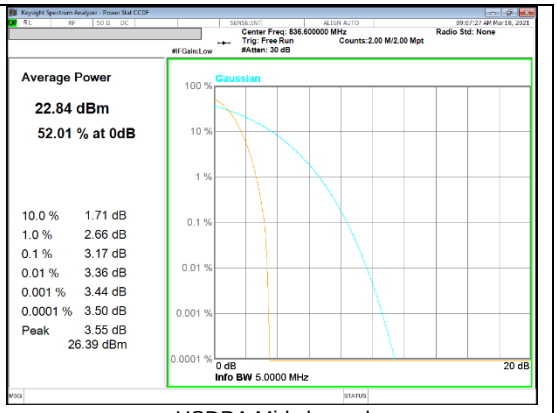
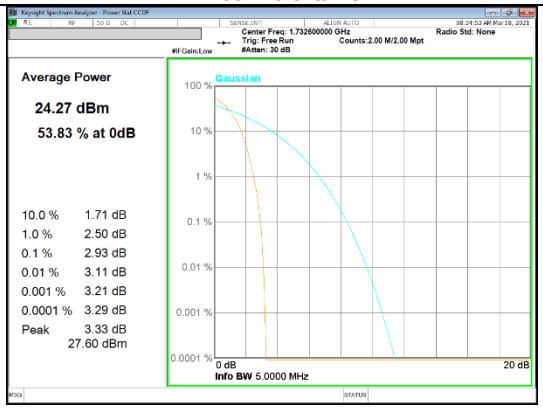
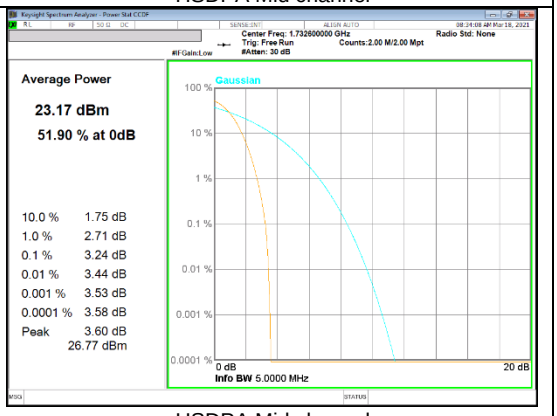
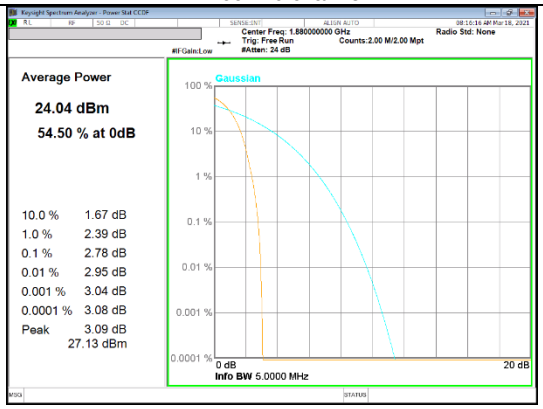
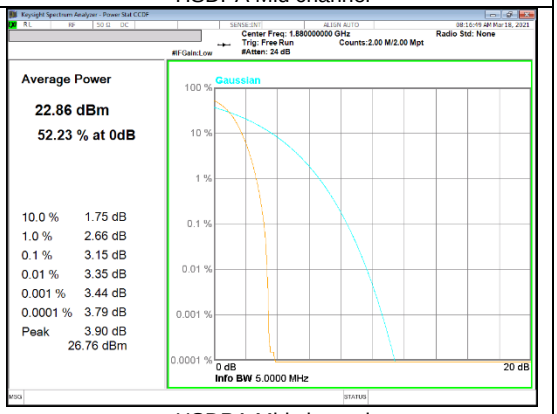
WCDMA

Band 5	 REL99 Mid channel	 HSDPA Mid channel
Band 4	 REL99 Mid channel	 HSDPA Mid channel
Band 2	 REL99 Mid channel	 HSDPA Mid channel

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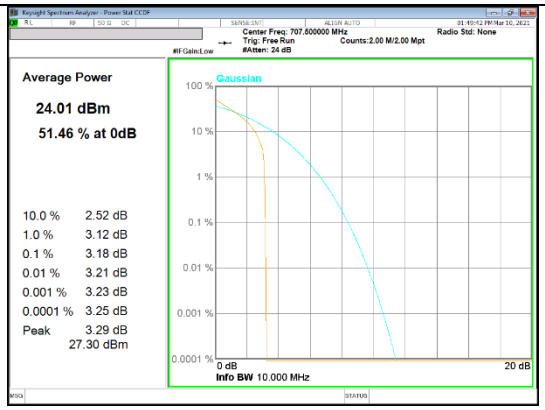
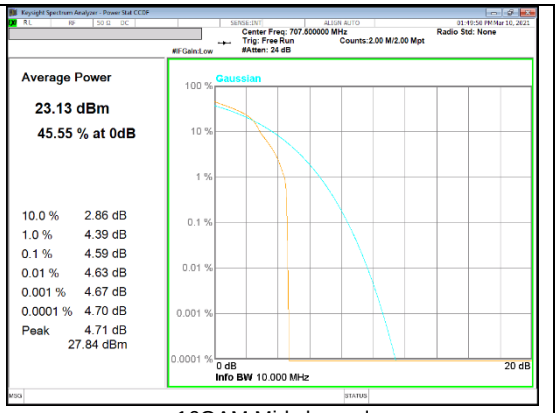
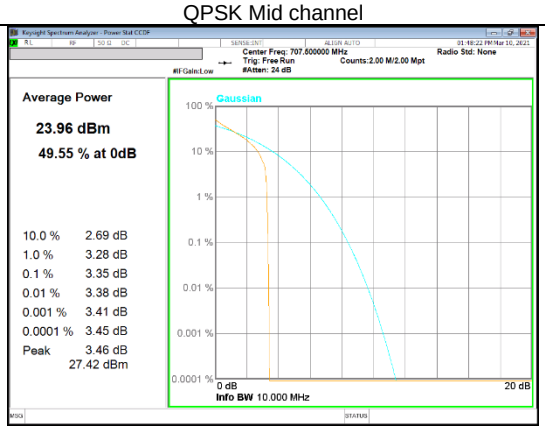
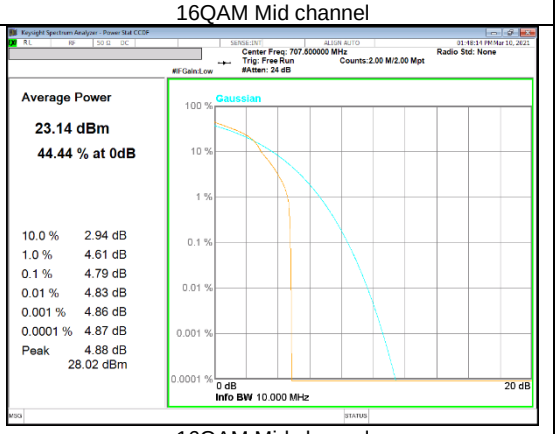
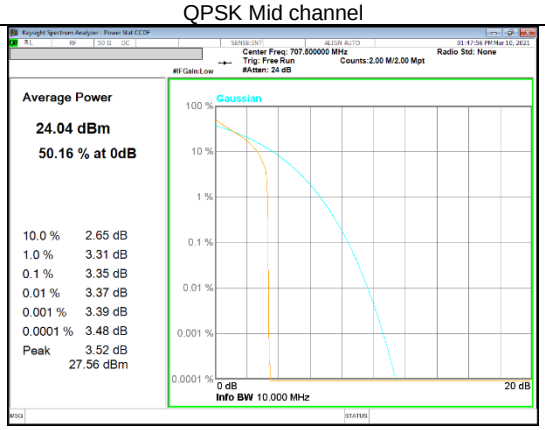
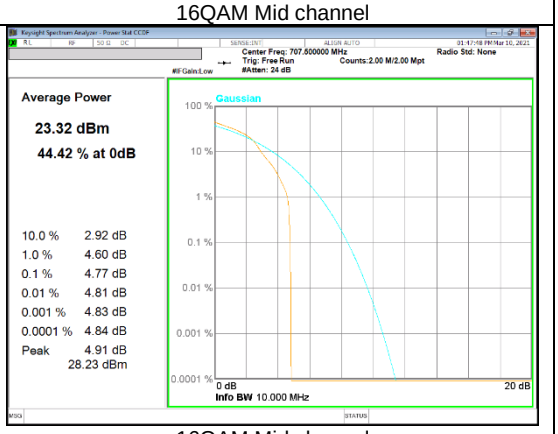
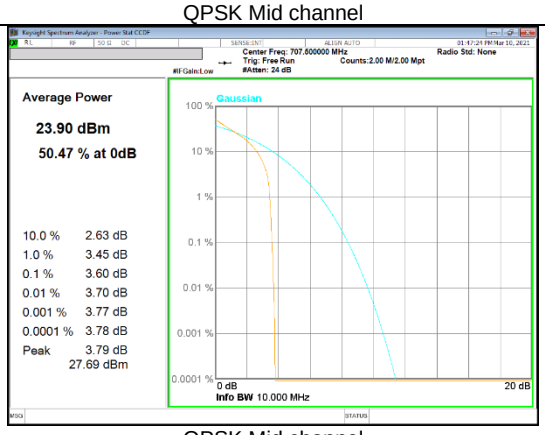
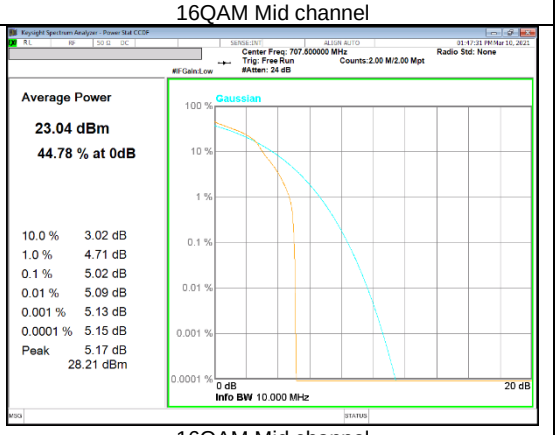
LTE Band 12

10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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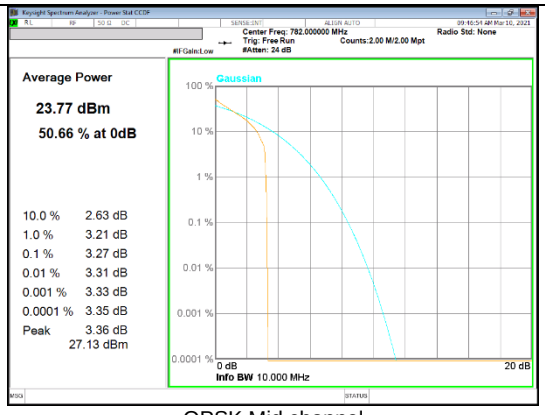
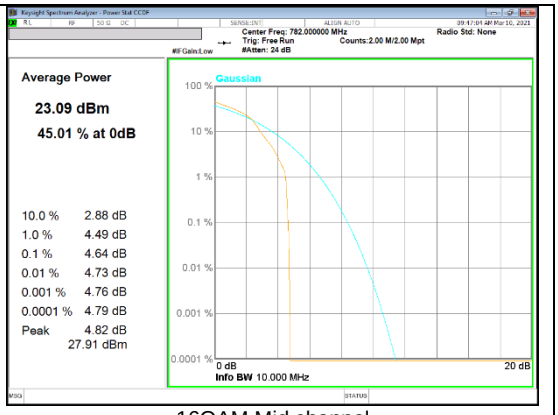
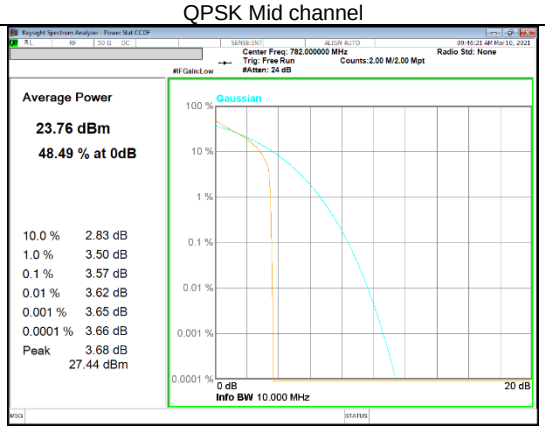
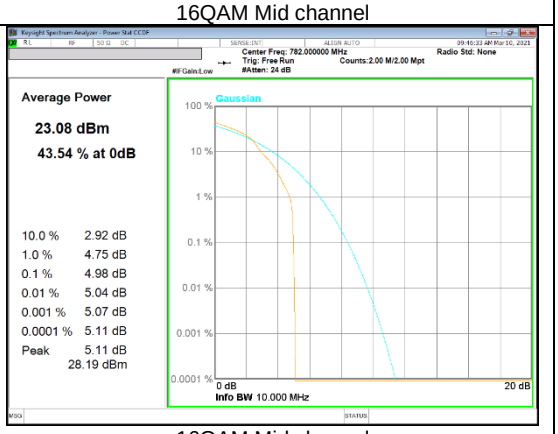
LTE Band 13

10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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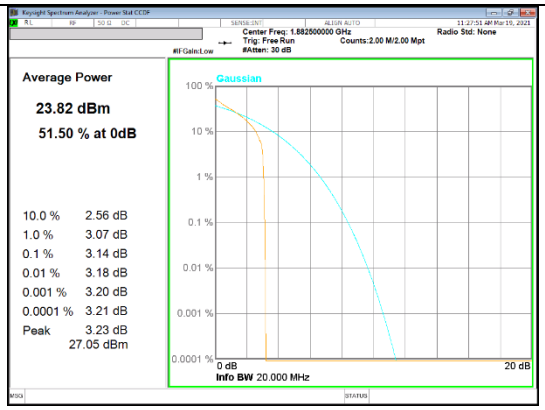
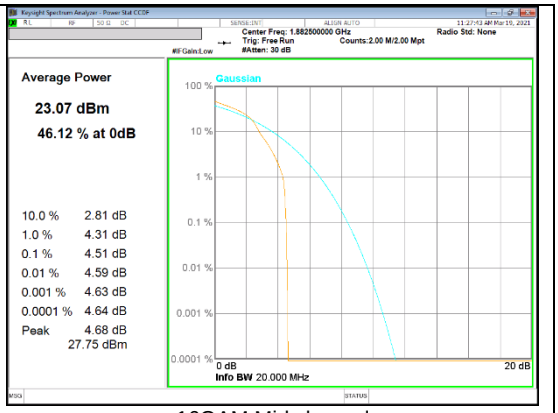
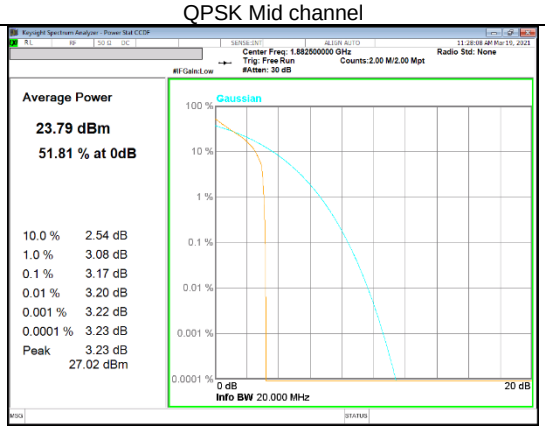
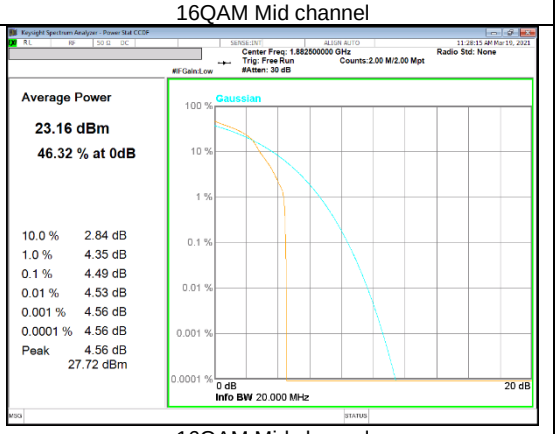
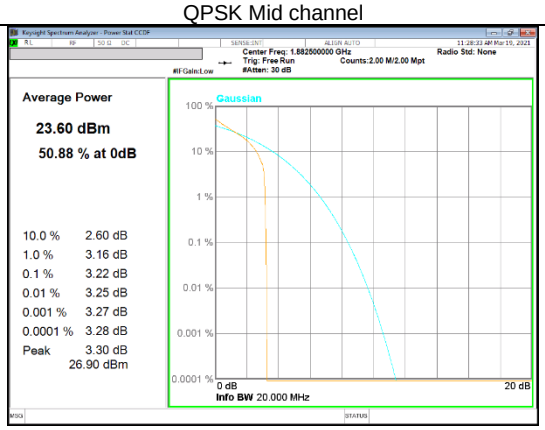
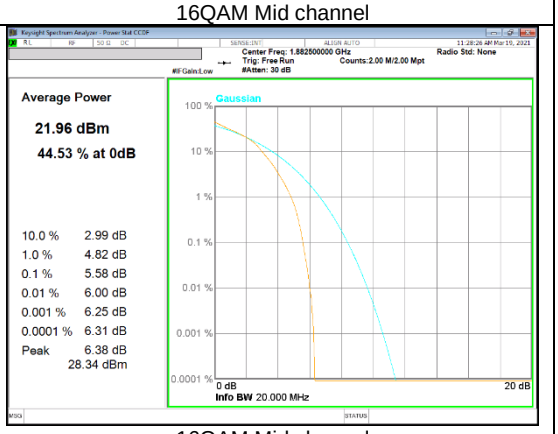
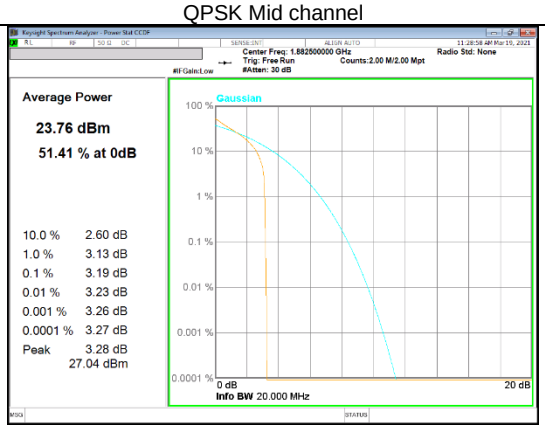
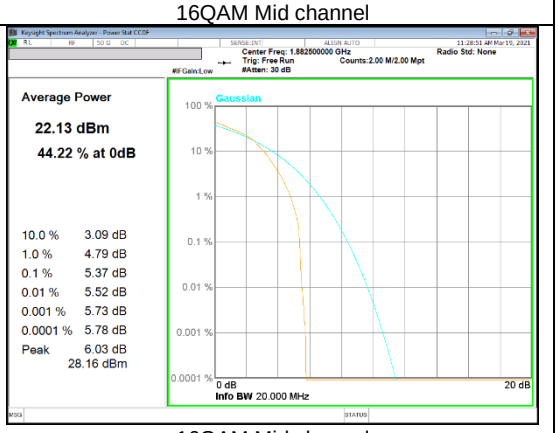
LTE Band 25

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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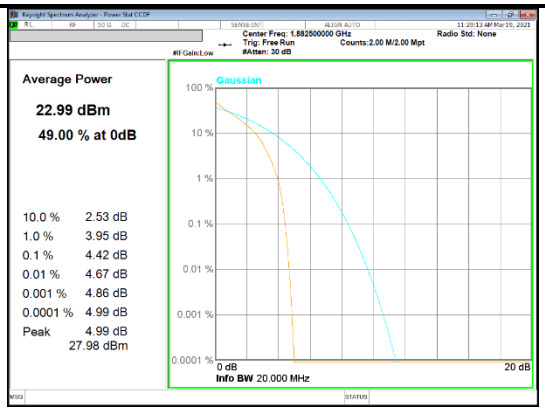
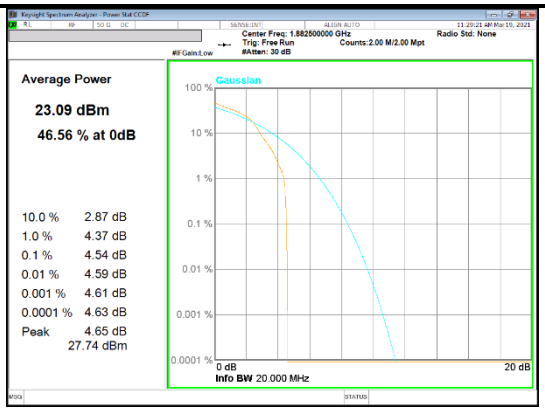
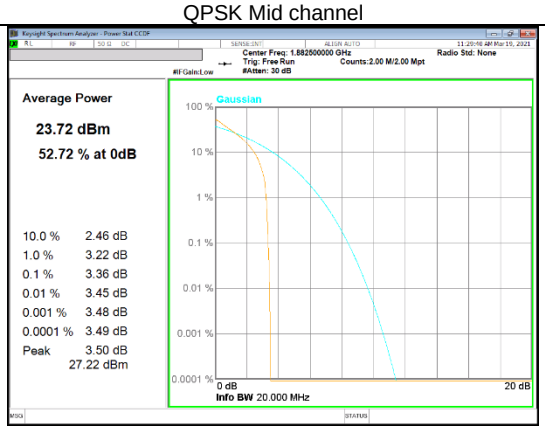
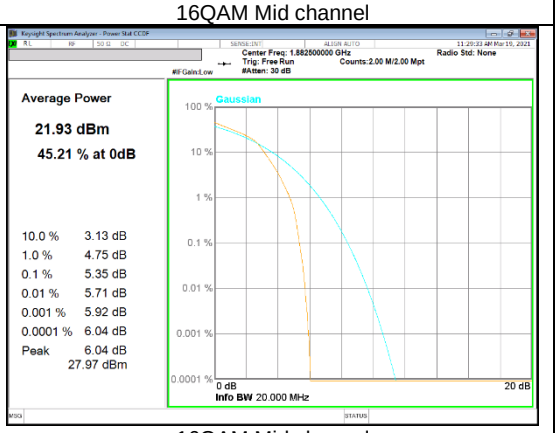
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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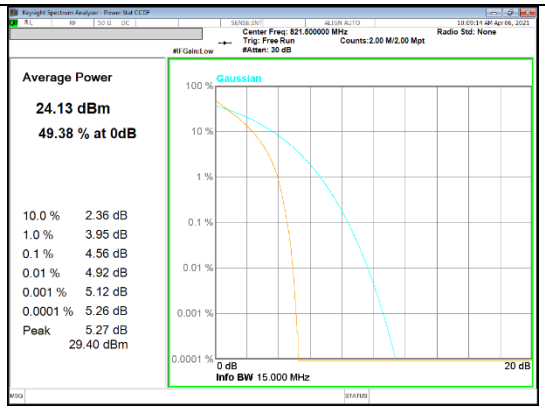
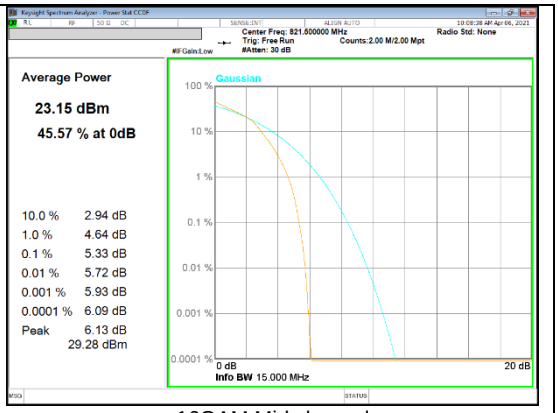
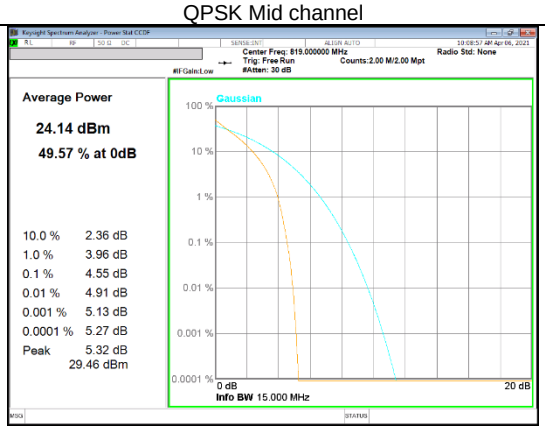
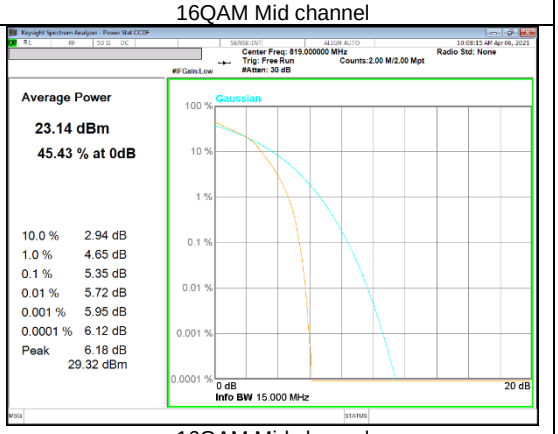
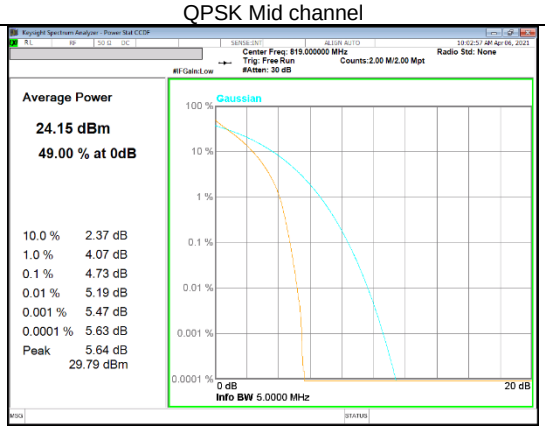
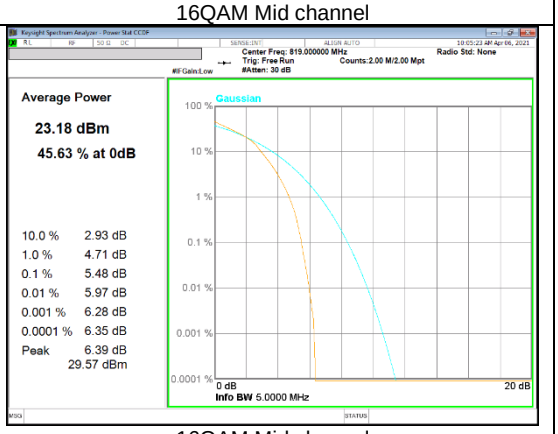
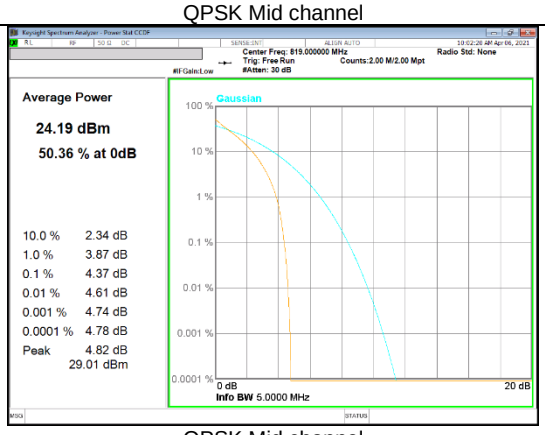
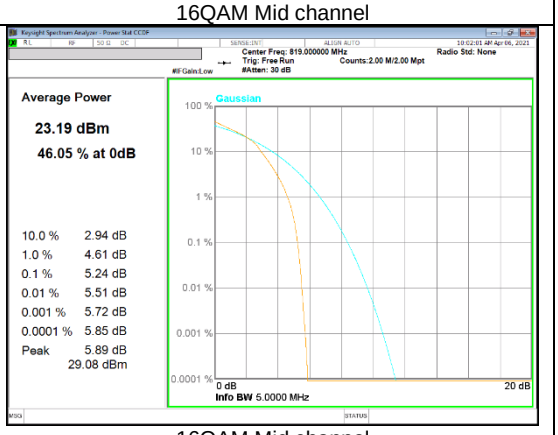
LTE Band 26 (Part 90)

15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel

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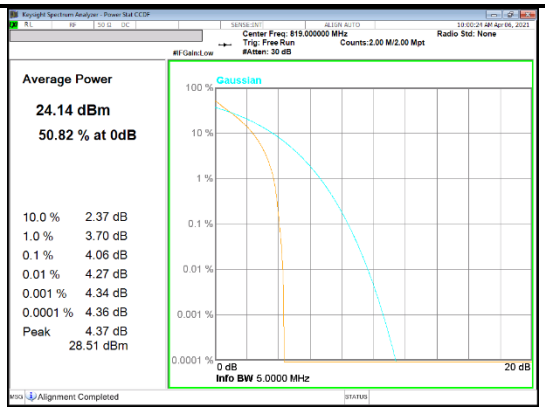
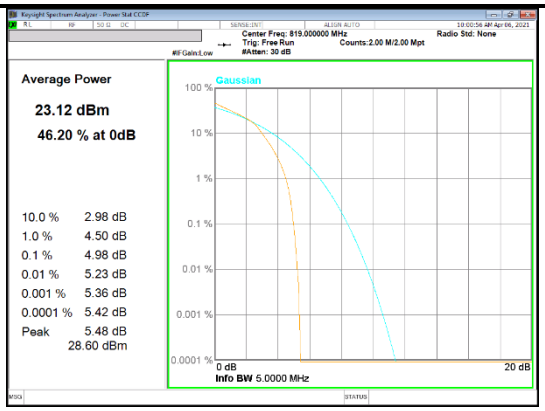
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

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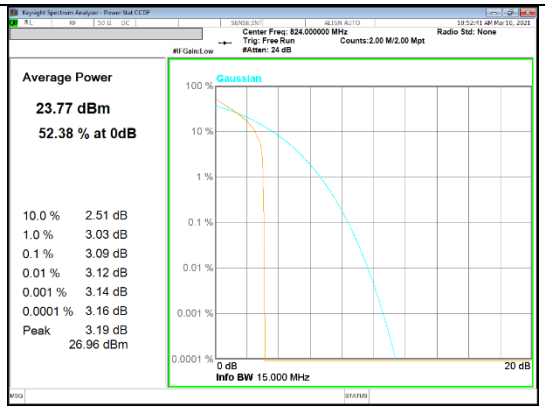
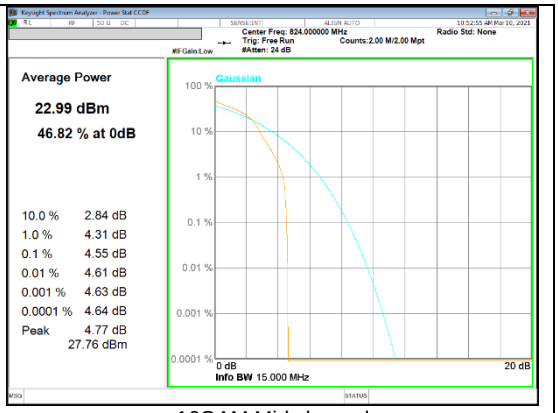
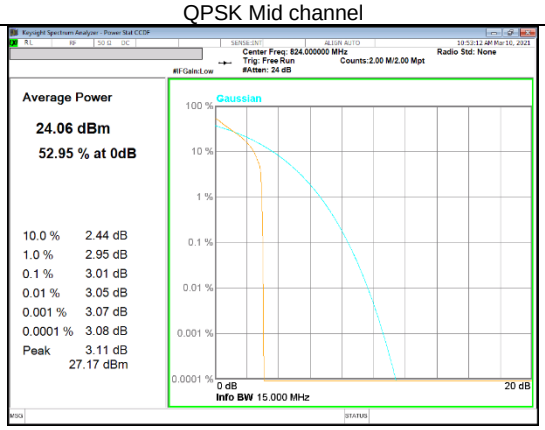
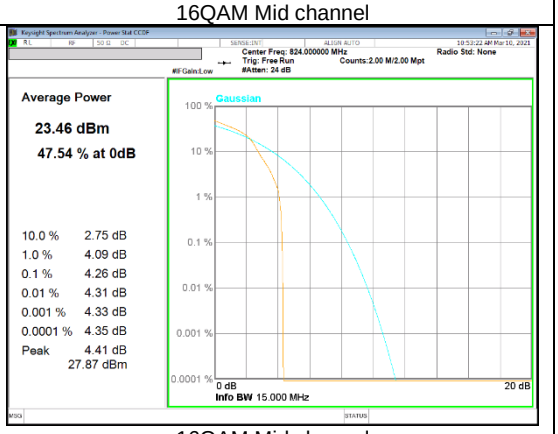
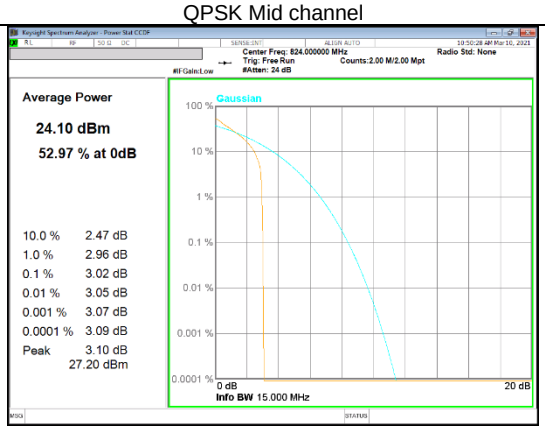
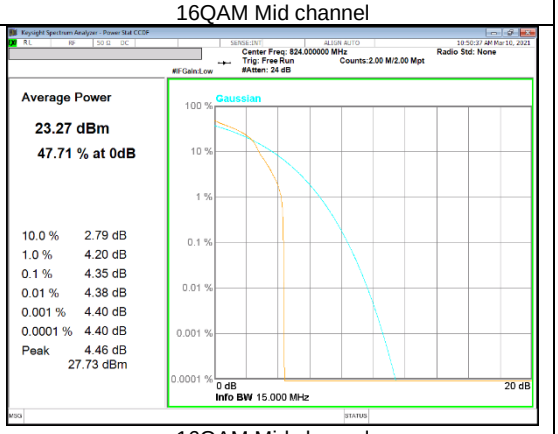
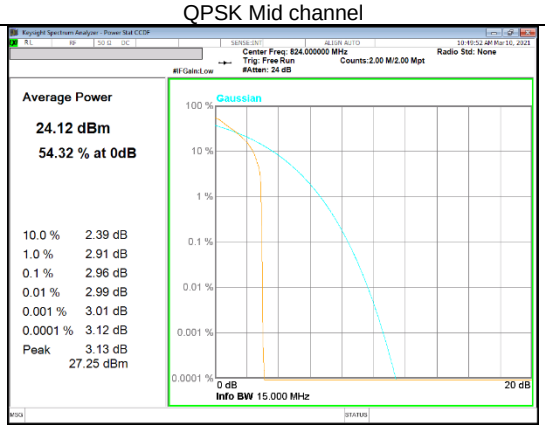
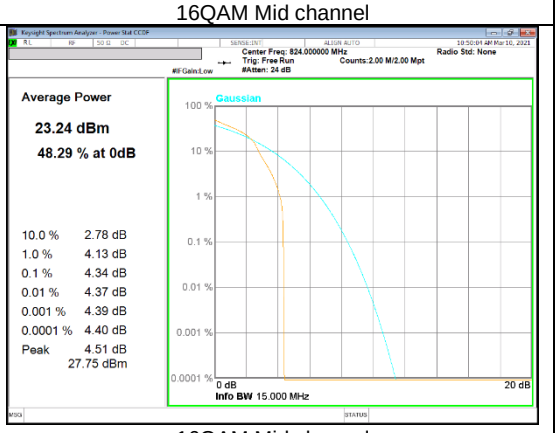
LTE Band 26 (Straddle)

15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel

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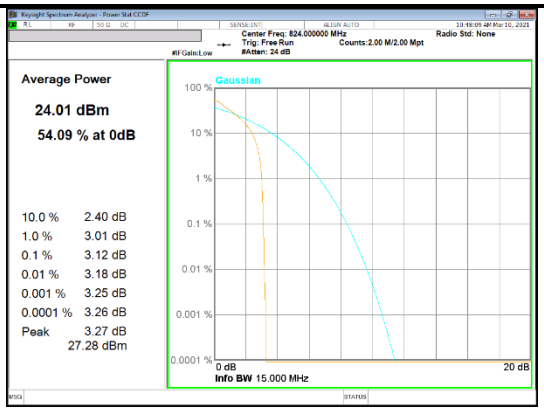
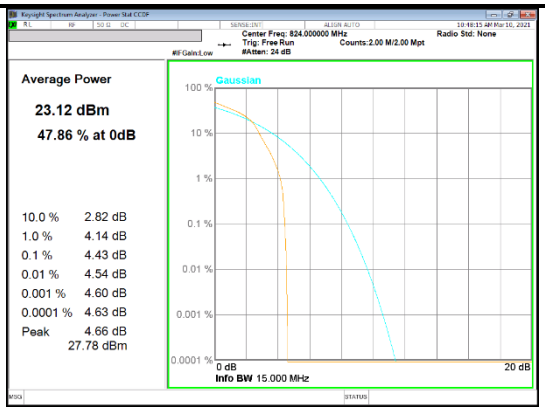
1.4 MHz		
	QPSK Mid channel	16QAM Mid channel

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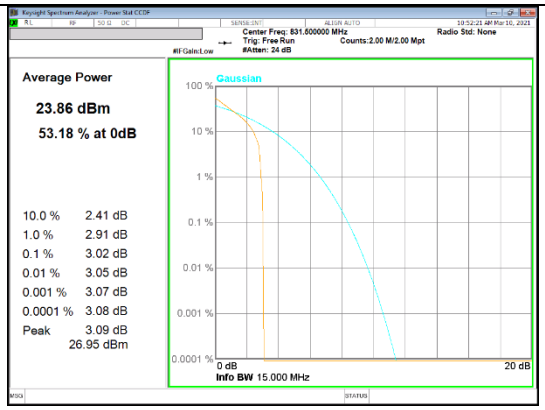
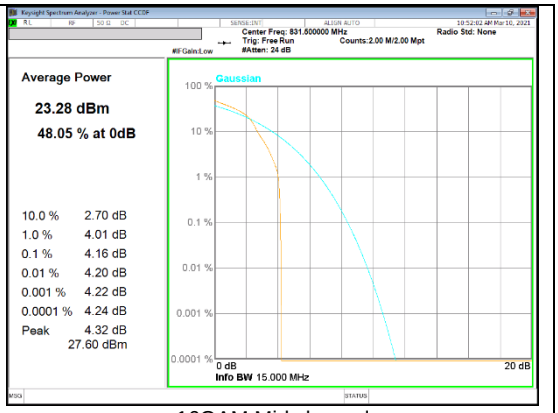
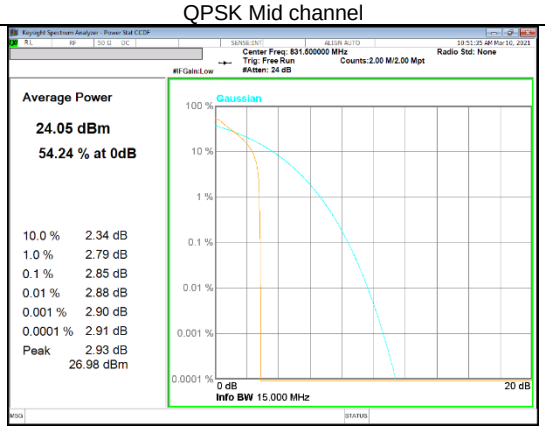
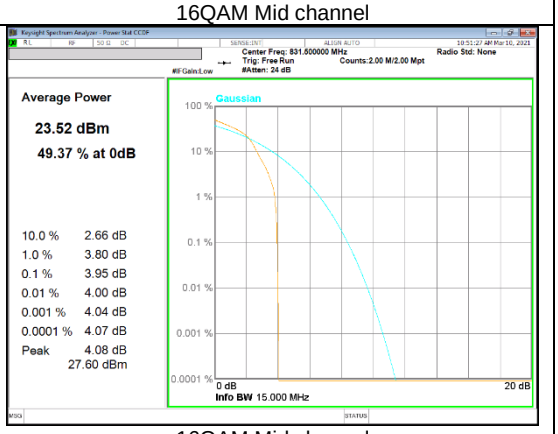
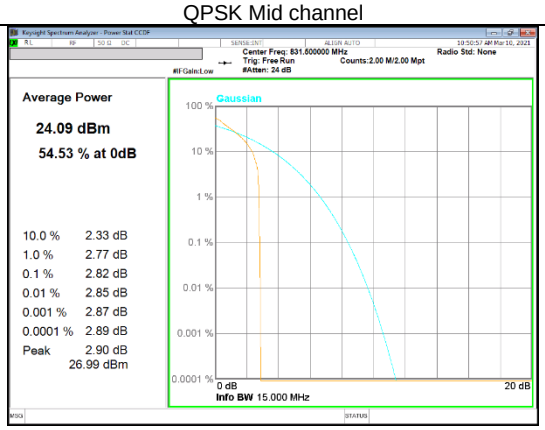
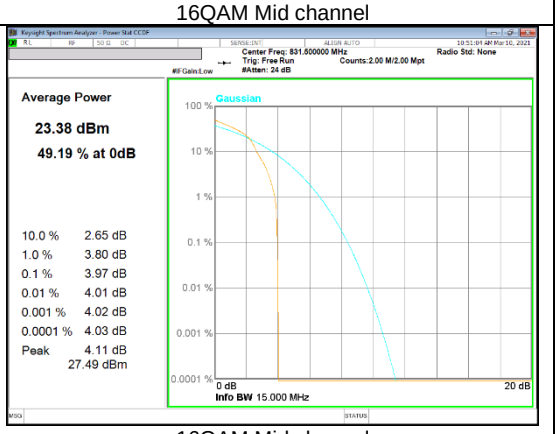
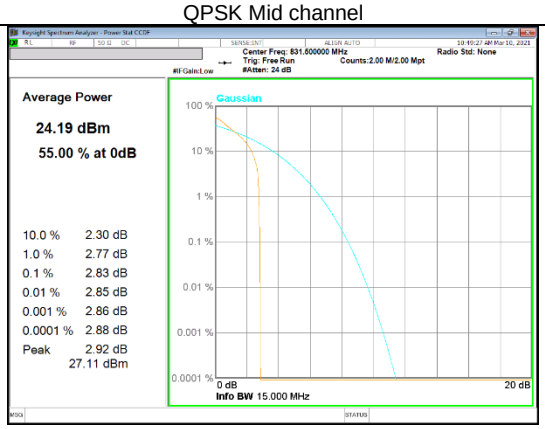
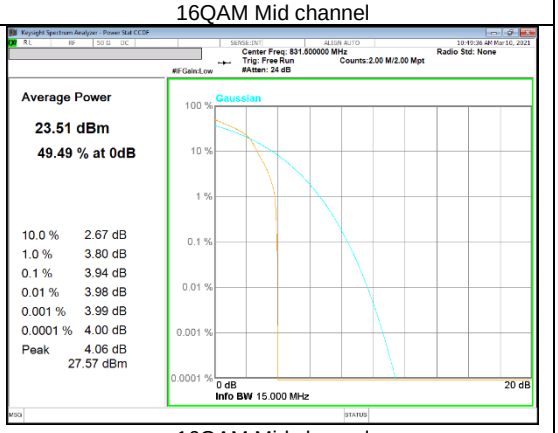
LTE Band 26 (Part 22)

15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel

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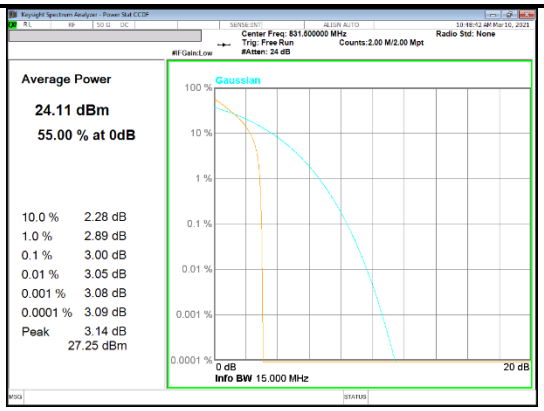
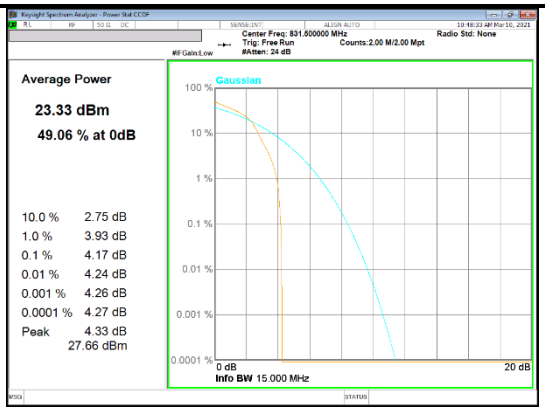
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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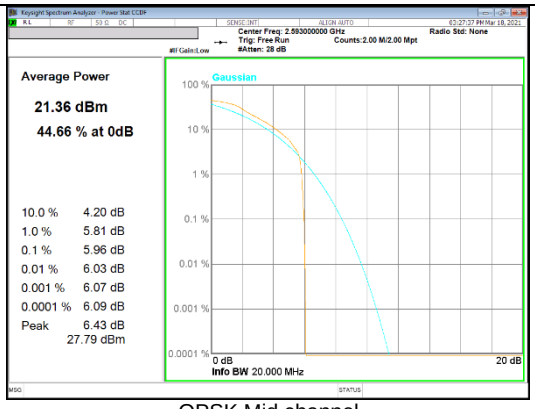
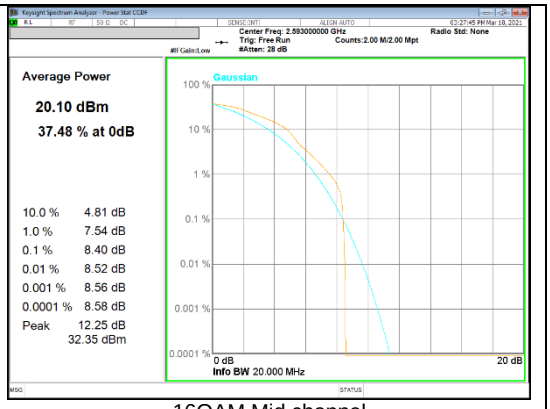
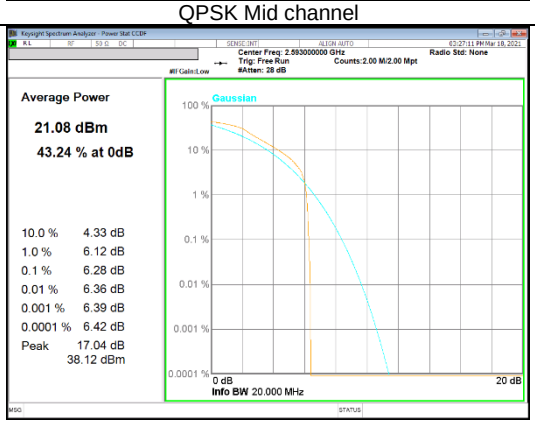
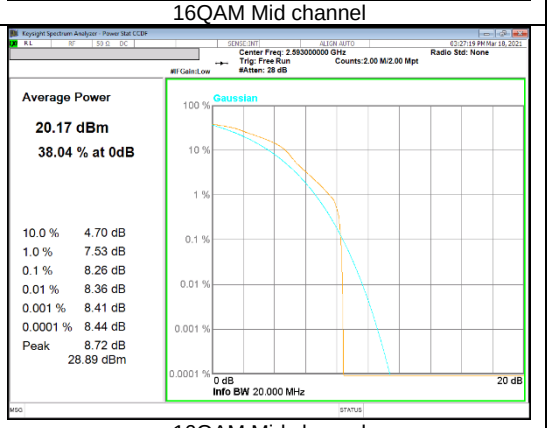
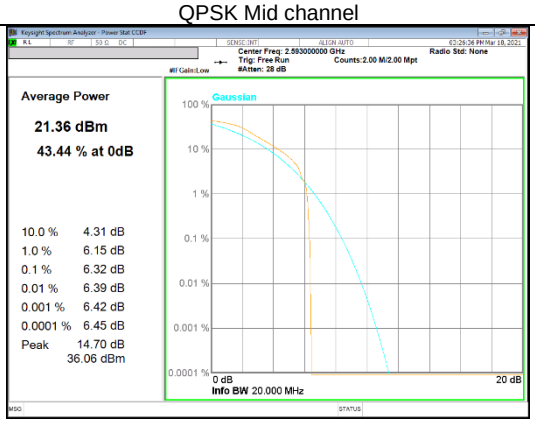
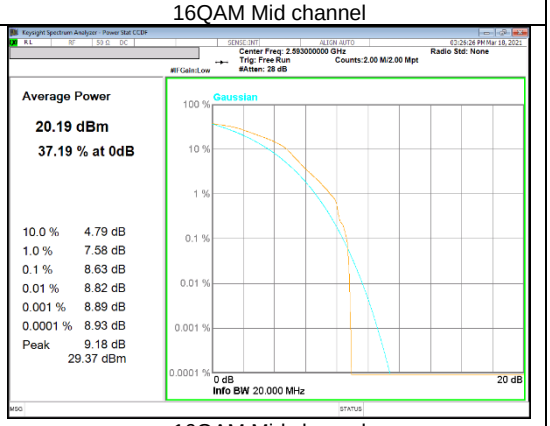
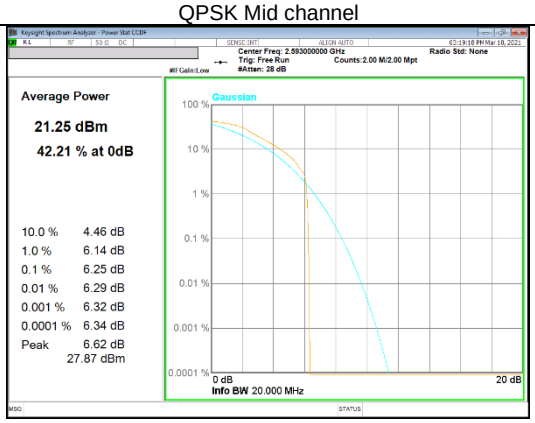
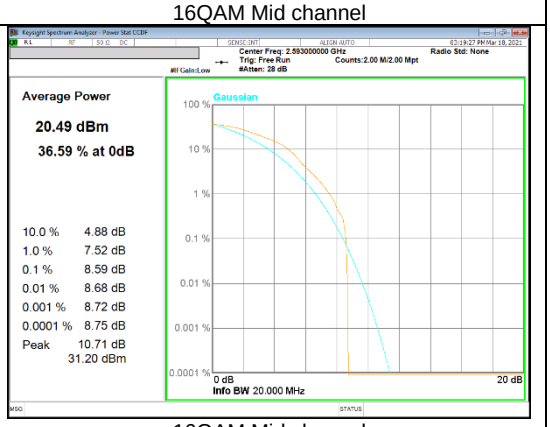
LTE Band 41

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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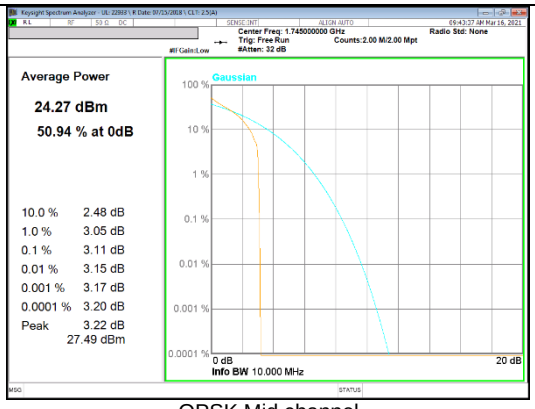
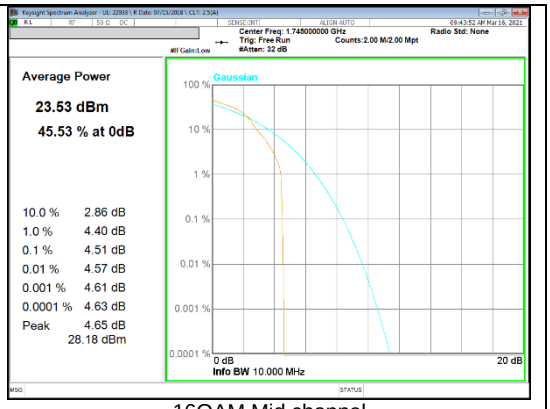
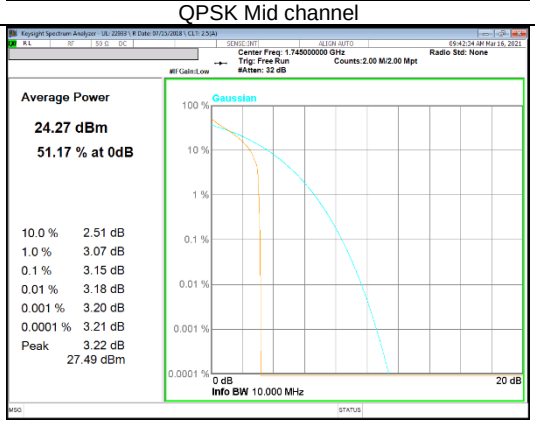
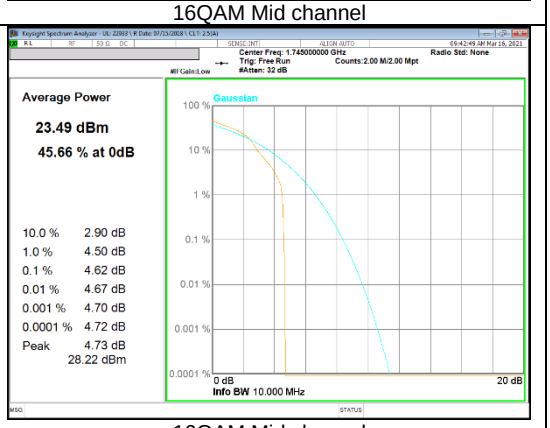
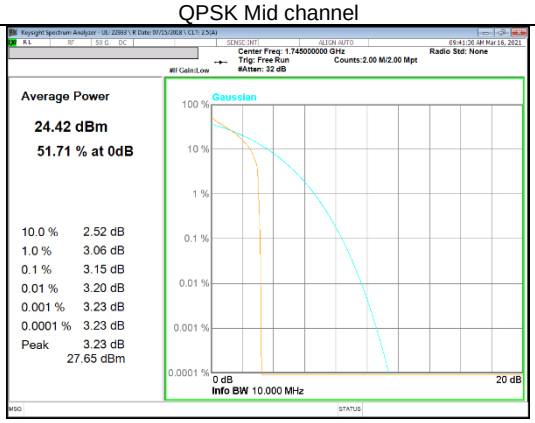
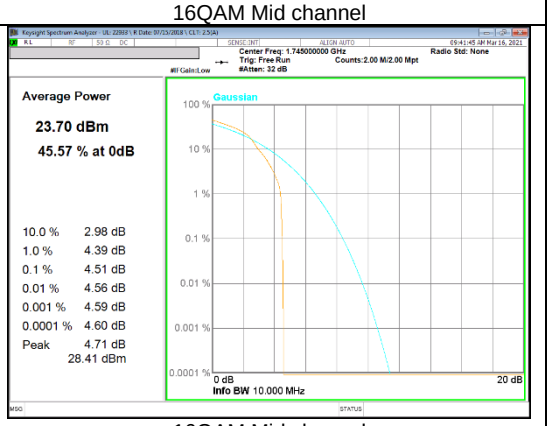
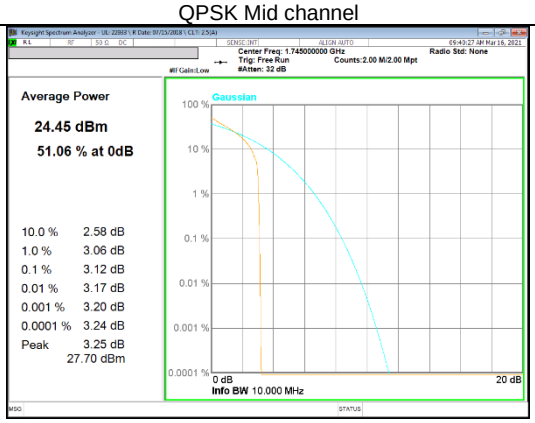
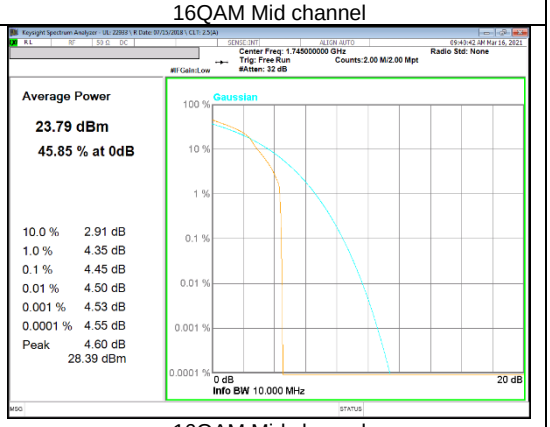
LTE Band 66

20 MHz	 QPSK Mid channel	 16QAM Mid channel
15 MHz	 QPSK Mid channel	 16QAM Mid channel
10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel

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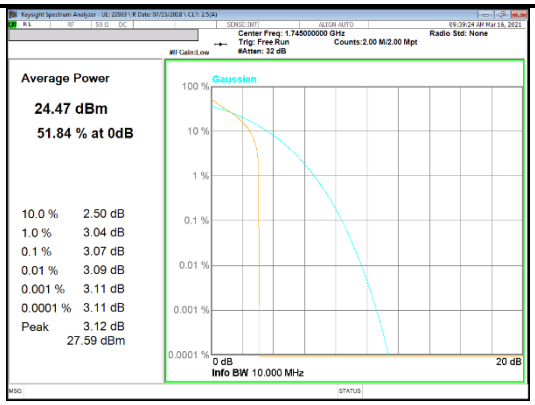
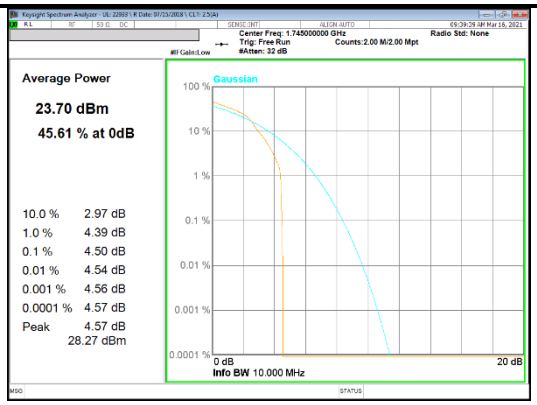
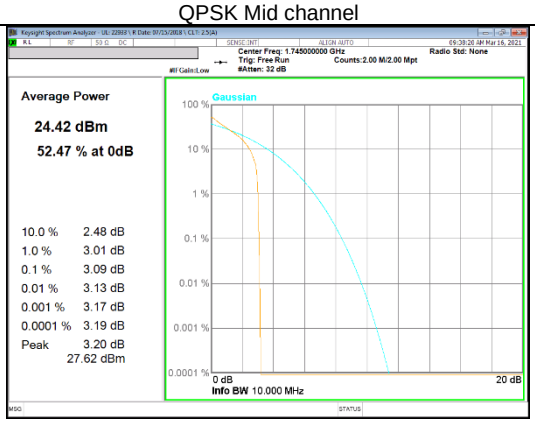
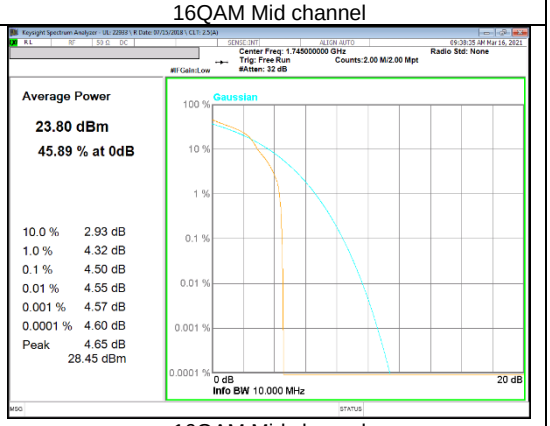
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

LTE Band 2

LTE Band 2(Frequency range: 1850-1910 MHz) is covered by LTE Band 25 (Frequency range: 1850-1915 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 4

LTE Band 4 (Frequency range: 1710-1755 MHz) is covered by LTE Band 66 (Frequency range: 1710-1780 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 5

LTE Band 5 (Frequency range: 824-849 MHz) is covered by LTE Band 26 (Frequency range: 814-849 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

LTE Band 17

LTE Band 17 (Frequency range: 704-716 MHz) is covered by LTE Band 12 (Frequency range: 699-716 MHz) due to overlapping frequency range, same maximum tune-up limit and same channel bandwidth.

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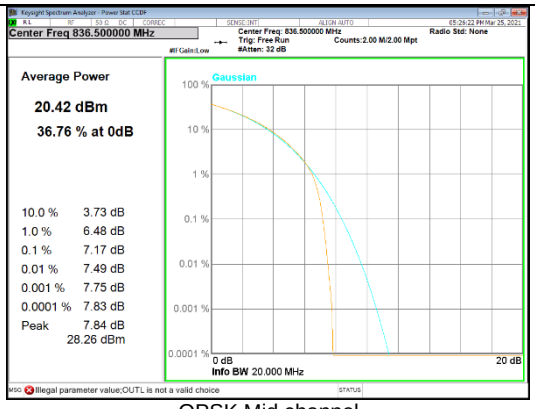
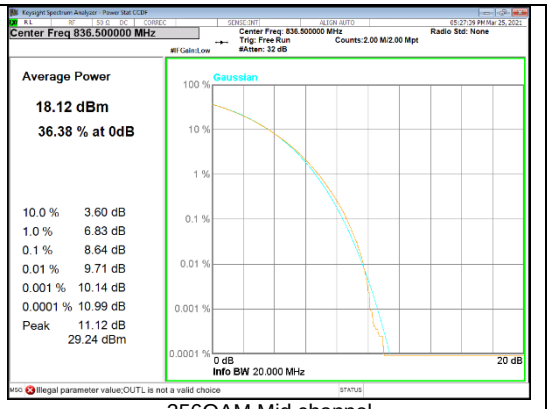
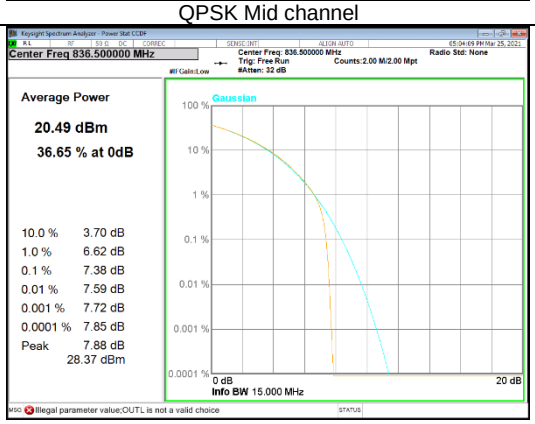
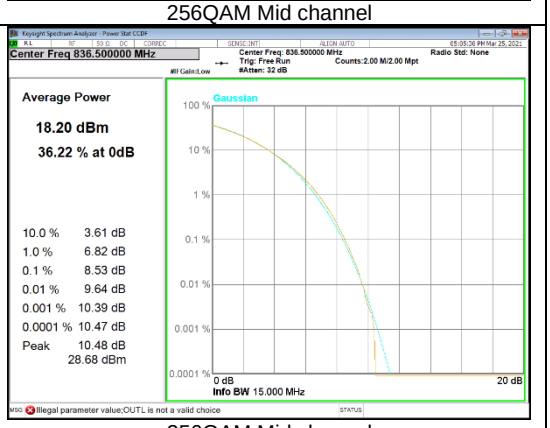
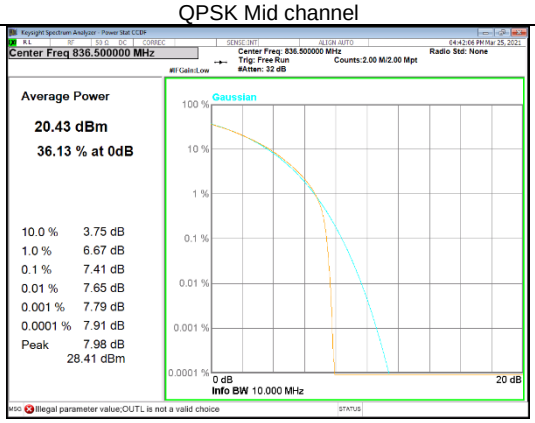
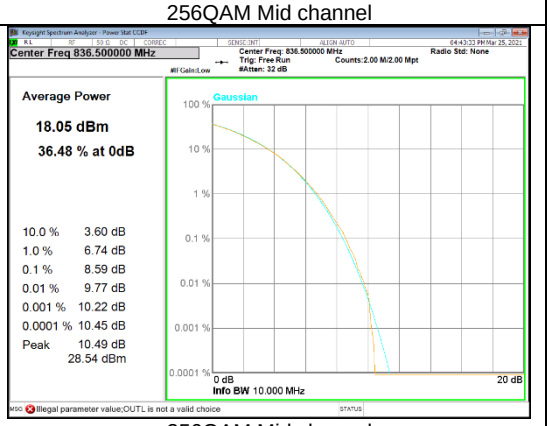
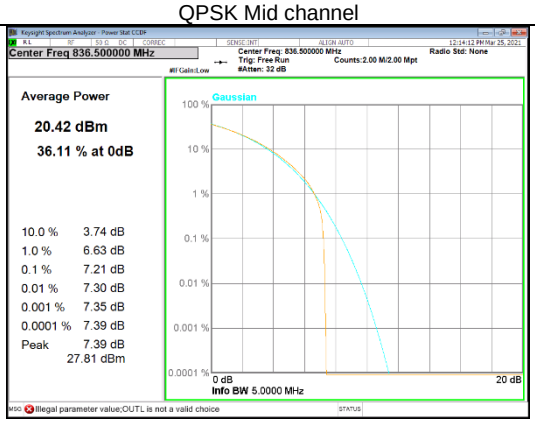
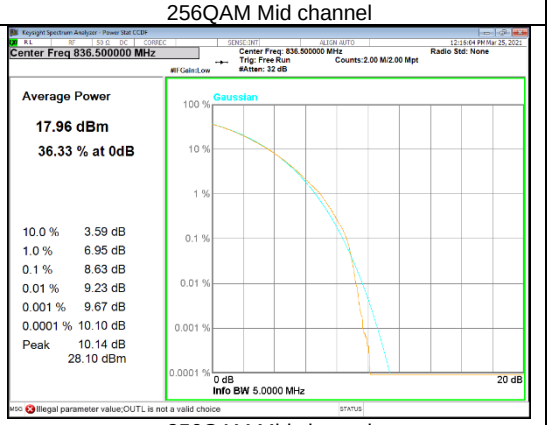
NR Band 5 CP-OFDM

20 MHz		
	QPSK Mid channel	256QAM Mid channel
15 MHz		
	QPSK Mid channel	256QAM Mid channel
10 MHz		
	QPSK Mid channel	256QAM Mid channel
5 MHz		
	QPSK Mid channel	256QAM Mid channel

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9. LIMITS AND CONDUCTED RESULTS

9.1. OCCUPIED BANDWIDTH

RULE PART(S)

FCC: §2.1049

LIMITS

For reporting purposes only

TEST PROCEDURE

The transmitter output was connected to a calibrated coaxial cable and coupler, the other end of which was connected to a spectrum analyzer. The occupied bandwidth was measured with the spectrum analyzer at the low, middle and high channel in each band. The -26dB bandwidth was also measured and recorded.

(KDB 971168 D01 Power Meas License Digital Systems v03r01)

Note

5G NR: All Waveforms (CP-OFDM vs DFT-s OFDM) and modulations (QPSK, 16QAM, 64QAM, 256QAM) were investigated to determine the worst case configuration. All modes of operation were investigated and the worst case configuration results are reported in this section.

RESULTS

See the following pages.

- **GSM**

Band	Modulation	f [MHz]	99% BW (kHz)	-26dB BW (kHz)
850	GPRS	836.6	244.84	313.0
	EGPRS		240.93	316.5
1900	GPRS	1880.0	242.79	310.4
	EGPRS		240.90	308.6

- **WCDMA**

Band	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
B5	Rel.99	836.6	4.137	4.682
	HSDPA		4.142	4.669
B4	Rel.99	1732.6	4.153	4.691
	HSDPA		4.147	4.665
B2	Rel.99	1880.0	4.147	4.705
	HSDPA		4.146	4.667

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- LTE Band 12

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B12	10M	QPSK	707.5	8.951	9.724
		16QAM		8.925	9.703
	5M	QPSK	707.5	4.484	4.899
		16QAM		4.481	4.879
	3M	QPSK	707.5	2.699	2.968
		16QAM		2.685	2.996
	1.4M	QPSK	707.5	1.082	1.215
		16QAM		1.086	1.228

- LTE Band 13

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B13	10M	QPSK	782.0	8.963	9.765
		16QAM		8.971	9.663
	5M	QPSK	782.0	4.487	4.896
		16QAM		4.489	4.900

- LTE Band 25

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B25	20M	QPSK	1882.5	17.933	20.640
		16QAM		17.899	19.150
	15M	QPSK	1882.5	13.446	14.630
		16QAM		13.416	14.470
	10M	QPSK	1882.5	8.977	9.786
		16QAM		8.966	9.686
	5M	QPSK	1882.5	4.494	4.972
		16QAM		4.504	4.928
	3M	QPSK	1882.5	2.700	2.998
		16QAM		2.688	2.928
	1.4M	QPSK	1882.5	1.081	1.230
		16QAM		1.087	1.228

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- LTE Band 26 (Part 90)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 Part(90)	15M	QPSK	821.5	13.395	14.580
		16QAM		13.408	14.430
	10M	QPSK	819.0	8.952	9.759
		16QAM		8.953	9.711
	5M	QPSK	819.0	4.477	4.906
		16QAM		4.486	4.934
	3M	QPSK	819.0	2.700	2.949
		16QAM		2.691	2.982
	1.4M	QPSK	819.0	1.081	1.223
		16QAM		1.083	1.212

- LTE Band 26 (Straddle)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Straddle)	15M	QPSK	824.0	13.394	14.560
		16QAM		13.424	14.500
	10M	QPSK	824.0	8.939	9.711
		16QAM		8.948	9.636
	5M	QPSK	824.0	4.486	4.924
		16QAM		4.495	4.913
	3M	QPSK	824.0	2.699	2.975
		16QAM		2.688	2.952
	1.4M	QPSK	824.0	1.085	1.220
		16QAM		1.088	1.229

- LTE Band 26 (Part 22)

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B26 (Part 22)	15M	QPSK	831.5	13.430	14.540
		16QAM		13.400	14.450
	10M	QPSK	831.5	8.951	9.649
		16QAM		8.945	9.697
	5M	QPSK	831.5	4.494	4.950
		16QAM		4.483	4.910
	3M	QPSK	831.5	2.695	2.984
		16QAM		2.688	2.988
	1.4M	QPSK	831.5	1.086	1.214
		16QAM		1.086	1.232

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- LTE Band 41

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B41	20M	QPSK	2593.0	17.906	20.680
		16QAM		17.892	19.410
	15M	QPSK	2593.0	13.425	17.910
		16QAM		13.436	14.690
	10M	QPSK	2593.0	8.970	9.720
		16QAM		8.943	9.628
	5M	QPSK	2593.0	4.495	4.967
		16QAM		4.486	4.936

- LTE Band 66

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
LTE B66	20M	QPSK	1745.0	17.856	19.250
		16QAM		17.849	19.320
	15M	QPSK	1745.0	13.413	14.580
		16QAM		13.408	14.490
	10M	QPSK	1745.0	8.983	9.788
		16QAM		8.981	9.719
	5M	QPSK	1745.0	4.494	4.927
		16QAM		4.482	4.904
	3M	QPSK	1745.0	2.690	2.968
		16QAM		2.687	2.968
	1.4M	QPSK	1745.0	1.090	1.218
		16QAM		1.085	1.231

- NR Band 5 CP-OFDM

Band	BW	Modulation	f [MHz]	99% BW (MHz)	-26dB BW (MHz)
NR B5	20M	QPSK	836.5	18.875	19.920
		256QAM		18.896	19.790
	15M	QPSK	836.5	14.104	14.790
		256QAM		14.121	14.830
	10M	QPSK	836.5	9.291	9.933
		256QAM		9.276	9.860
	5M	QPSK	836.5	4.481	4.932
		256QAM		4.480	4.967

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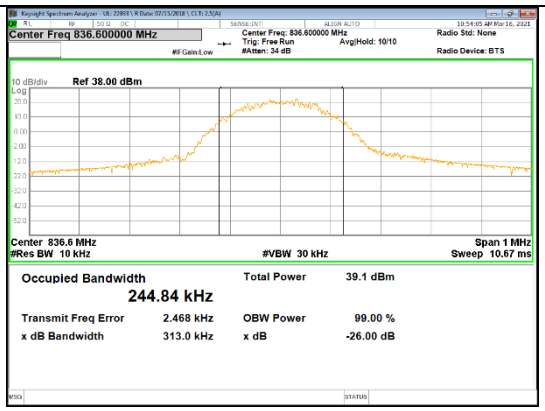
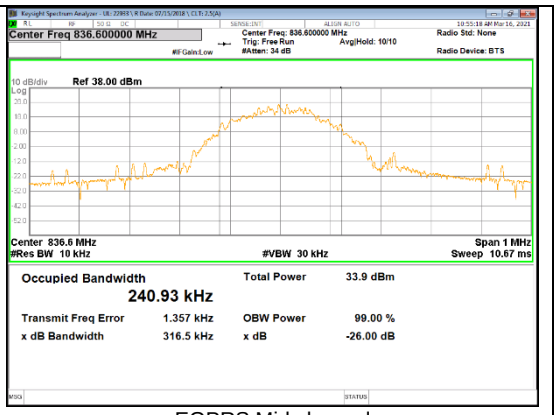
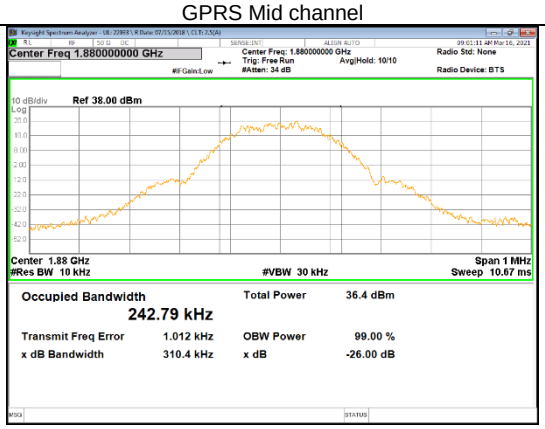
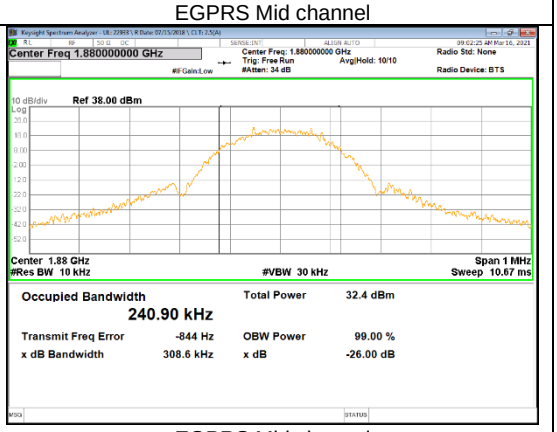
9.1.1. OCCUPIED BANDWIDTH RESULTS

GSM

850	 GPRS Mid channel	 EGPRS Mid channel
1900	 GPRS Mid channel	 EGPRS Mid channel

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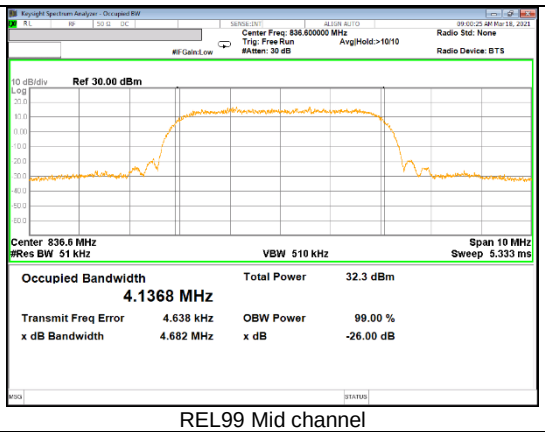
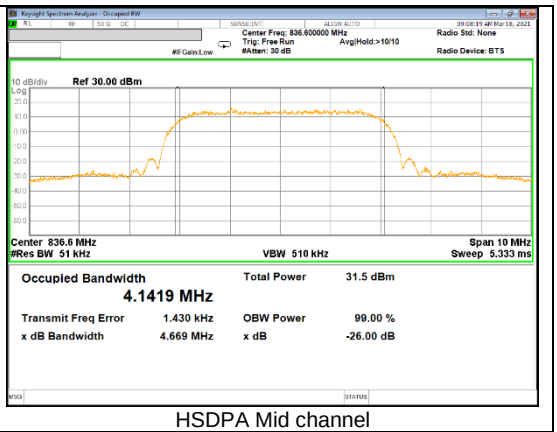
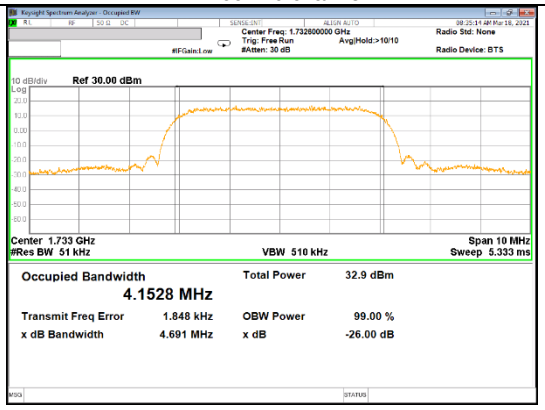
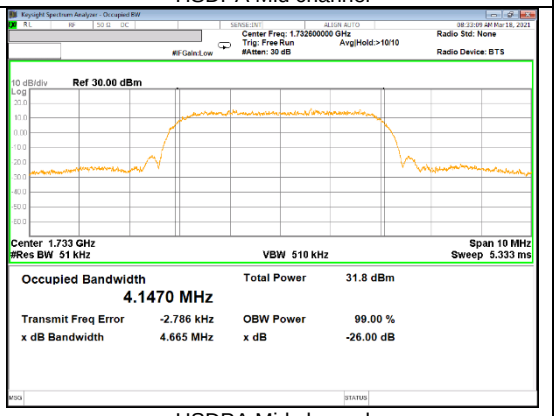
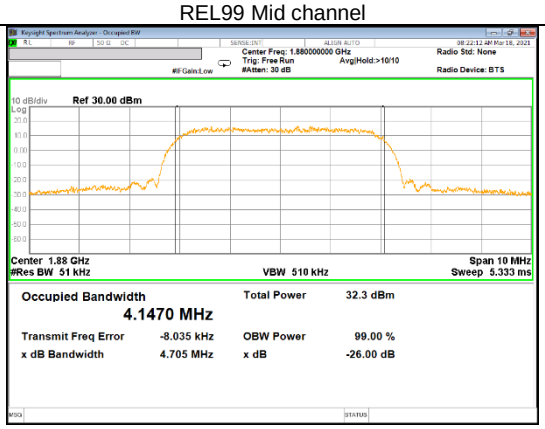
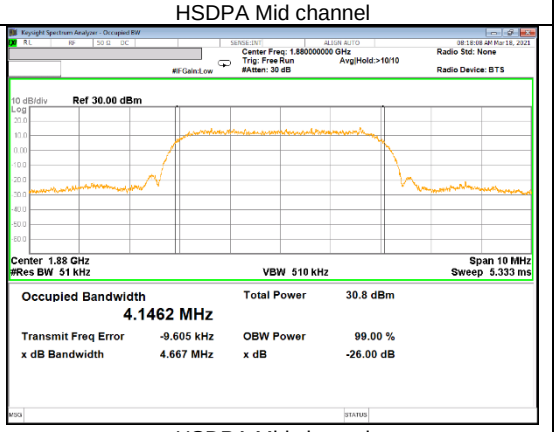
WCDMA

Band 5	 REL99 Mid channel	 HSDPA Mid channel
Band 4	 REL99 Mid channel	 HSDPA Mid channel
Band 2	 REL99 Mid channel	 HSDPA Mid channel

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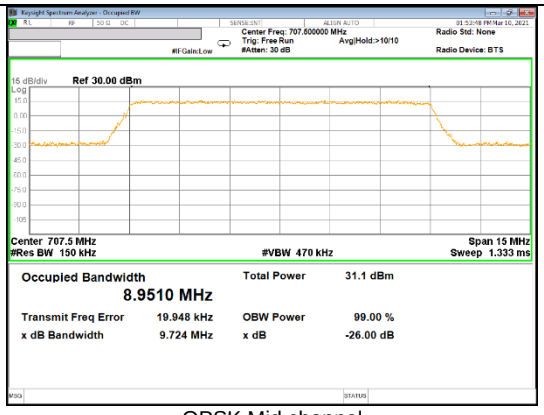
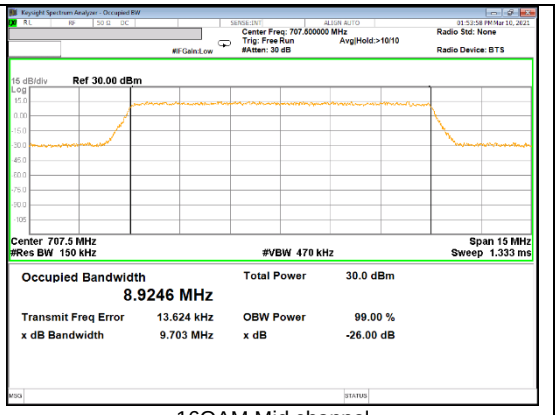
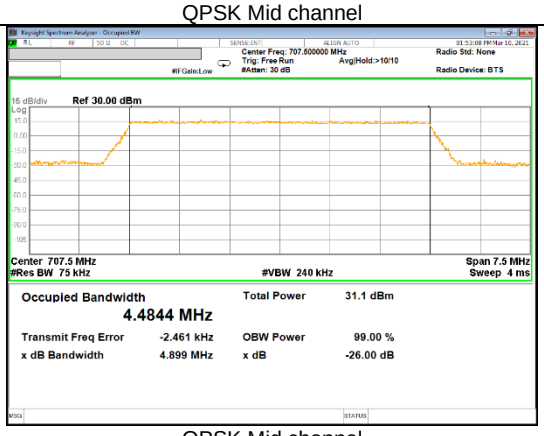
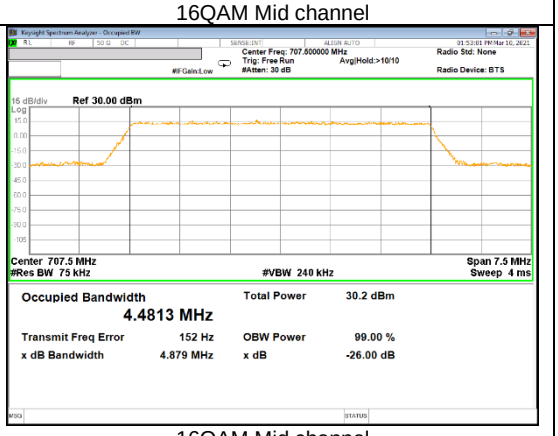
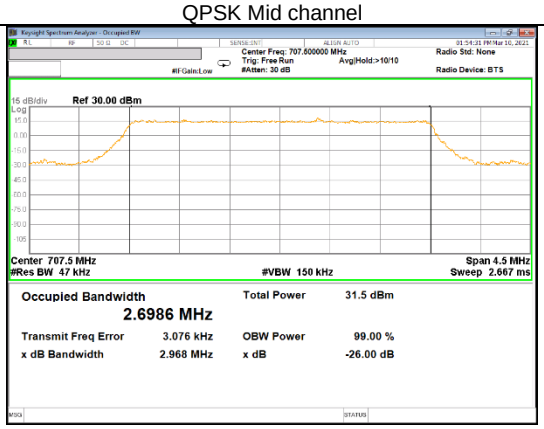
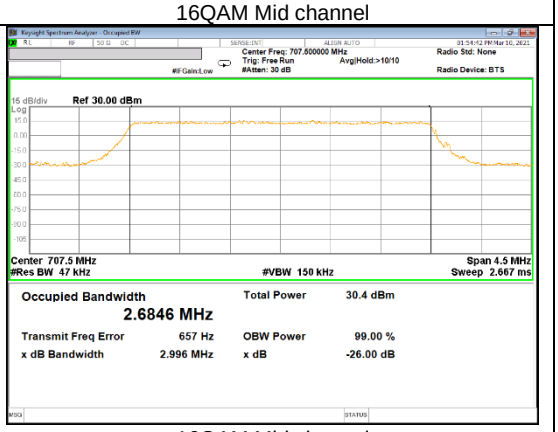
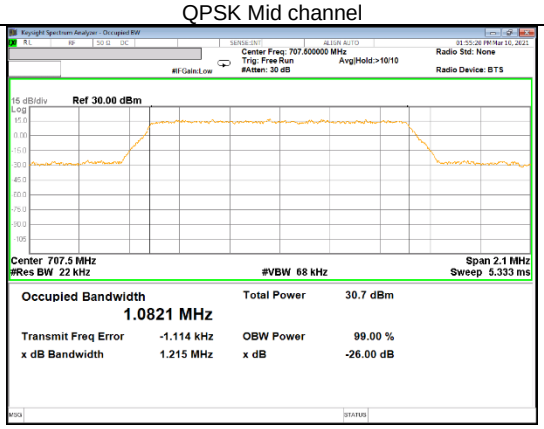
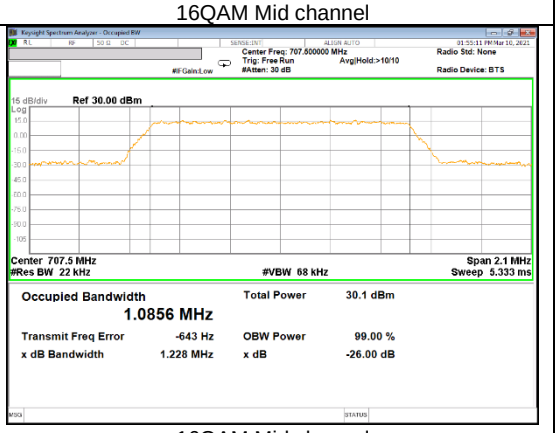
LTE Band 12

10 MHz	 QPSK Mid channel	 16QAM Mid channel
5 MHz	 QPSK Mid channel	 16QAM Mid channel
3 MHz	 QPSK Mid channel	 16QAM Mid channel
1.4 MHz	 QPSK Mid channel	 16QAM Mid channel

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